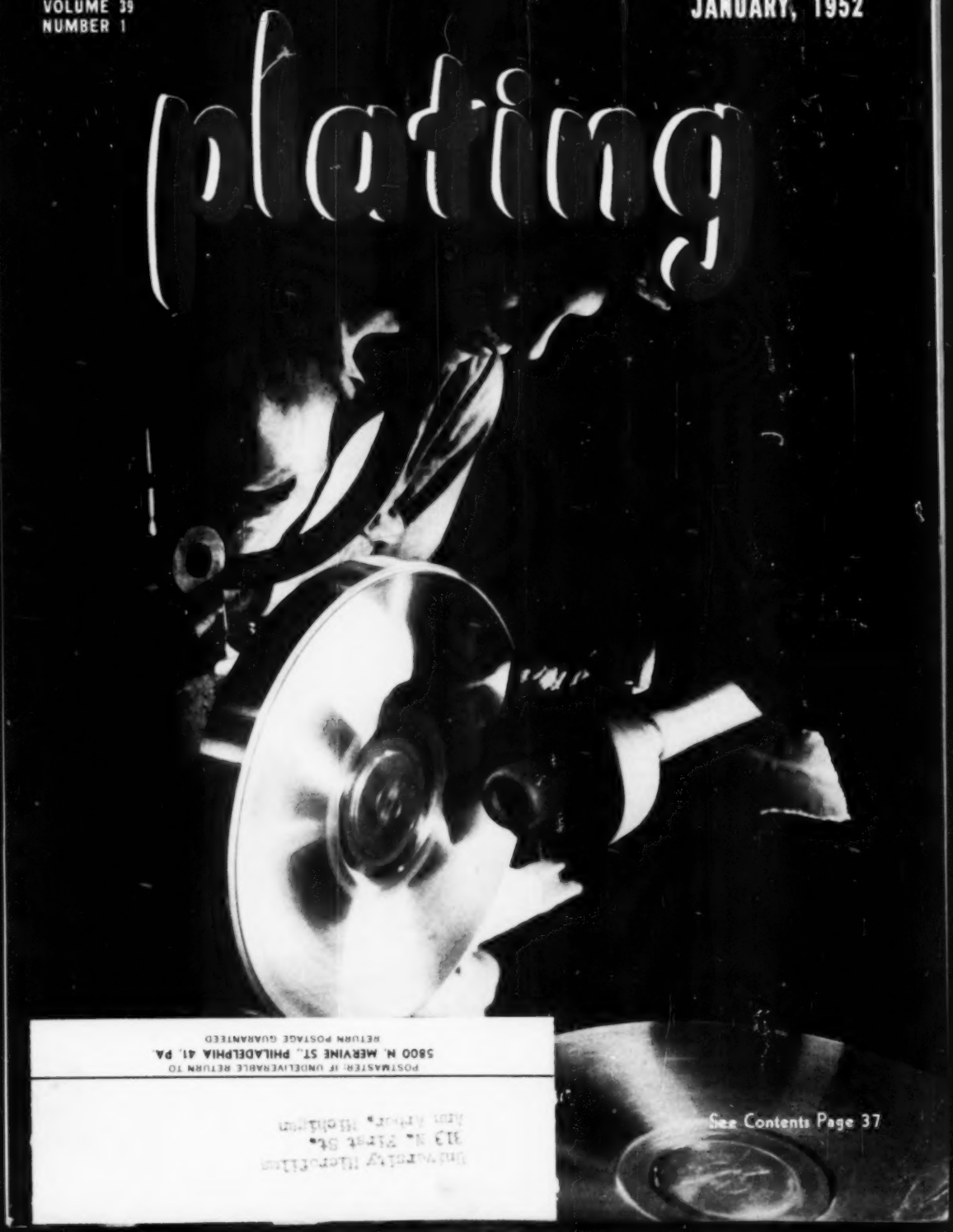
VOLUME 39
NUMBER 1

JANUARY, 1952

plating



See Contents Page 37

POSTMASTER: IF UNDELIVERABLE RETURN TO
5800 N. MERVINE ST., PHILADELPHIA 41, PA.
RETURN POSTAGE GUARANTEED

DUXBAK "S"

A 100% WATER SHEDDING RUST PREVENTATIVE *

Ideal for Rust Proofing wet or dry Steel between machining Operations and as a final coating for Stock Storage.

DUXBAK "S" can easily be removed in an Alkali Cleaner — Prior to further finishing operations.

These and other uses for DUXBAK "S" are described in detail on page 29 of our Clepo Cleaning Catalog.

A Request on your Company Letterhead will bring this information to you immediately.

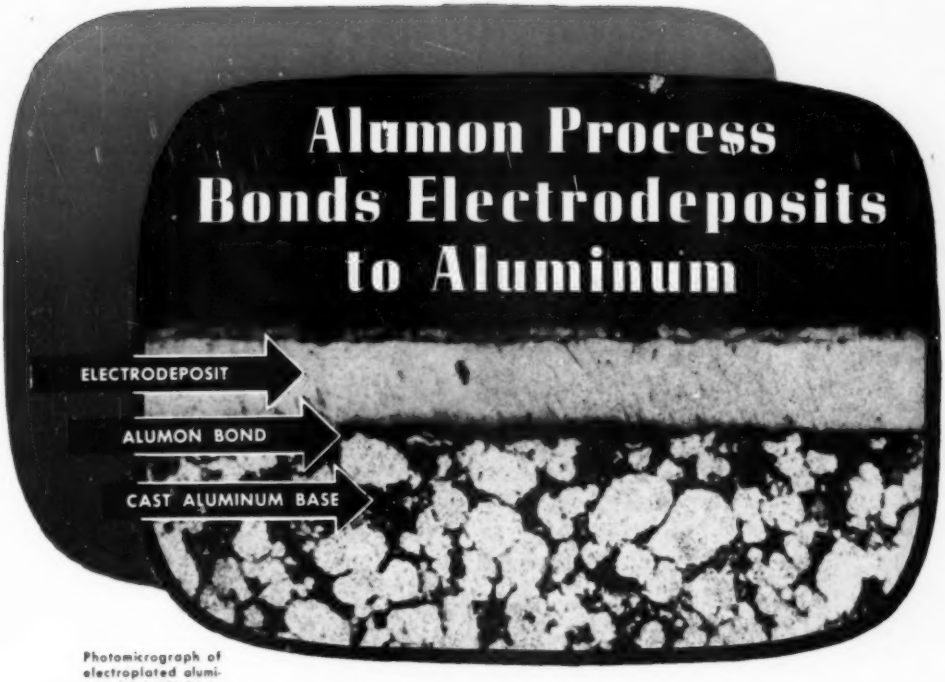
*SHEDS WATER LIKE A DUCK'S BACK

FREDERICK **GUMM** *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N. J.

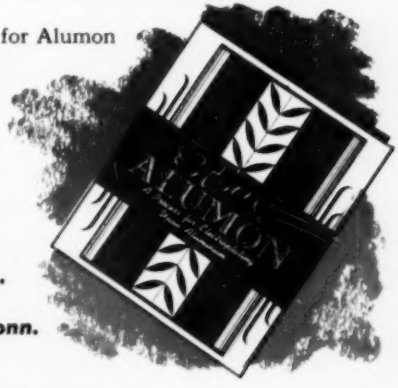
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 100.

Alumon Process Bonds Electrodeposits to Aluminum



Photomicrograph of electroplated aluminum showing high tensile Alumon Bond.

Hundreds of manufacturers throughout the United States are now using electroplated aluminum. The Alumon process is simple. The work is merely cleaned, dipped in acid, dipped in Alumon and is then ready for electroplating with copper, nickel, and other metals. The process is suitable for plating most wrought and cast alloys . . . The cost of using alumon is low, being less than half a cent per square foot of surface area treated. The process can be fitted easily into regular plating cycles. Write today for Alumon Process bulletin and technical data on how you can use electroplated aluminum for your products.



Enthone INC.

442 Elm Street, New Haven, Conn.

Bonus Performance

Filtering any plating solution . . . any quantity

INDUSTRIAL Filters

Portable and stationary models. Capacities from 100 to 15,000 gph. Special filtering systems engineered to meet unusual conditions.

and it's performance that counts

The engineering, design, and construction of INDUSTRIAL filters have proved out in long service. With the outlet near the top of the chamber, a uniform precoat is deposited on the filter leaves as the solution fills the chamber. The outside lockup simplifies the lockup of the leaf and bag assemblies. INDUSTRIAL exclusive air-wash cleaning method practically eliminates the usual labor, downtime, and the inconveniences of dismantling the filter after each cycle. INDUSTRIAL filters are often in operation for months without removing the cover. All these features add up to bonus performance—clear filtrate at low over-all cost per gallon.

Ask for Bulletin 100-EP

This bulletin gives the complete details of all INDUSTRIAL features, description of the different standard models, and the capacities of the standard sizes.

INDUSTRIAL Water Demineralizers

Eliminate stains after hot rinses; prevent unwanted precipitates in solutions.

Standard INDUSTRIAL demineralizer units are available with capacities of 200 to 1000 gph. Special units of any capacity are engineered to requirements.

Write for Full Information and Recommendations

FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity

INDUSTRIAL FILTER & PUMP MFG. CO.

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RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS

Industry News

Lea Expands. About three years ago, the Lea Manufacturing Company, located for many years in leased space at 16 Cherry Ave., Waterbury, Conn., began its long-planned expansion program. It purchased a large plot with railroad siding on the west side of the city, toward Water-

Building in foreground, new manufacturing plant; in background, storage building

town. The first building, with some 10,000 sq ft of floor space, was laid out for storage of the large tonnage of resale items for plating and finishing plants, as well as for its own raw materials—abrasive, glues, tallow, etc.,—needed in the manufacture of polishing, buffing, etc., compounds sold all over the world.

Interior of manufacturing plant

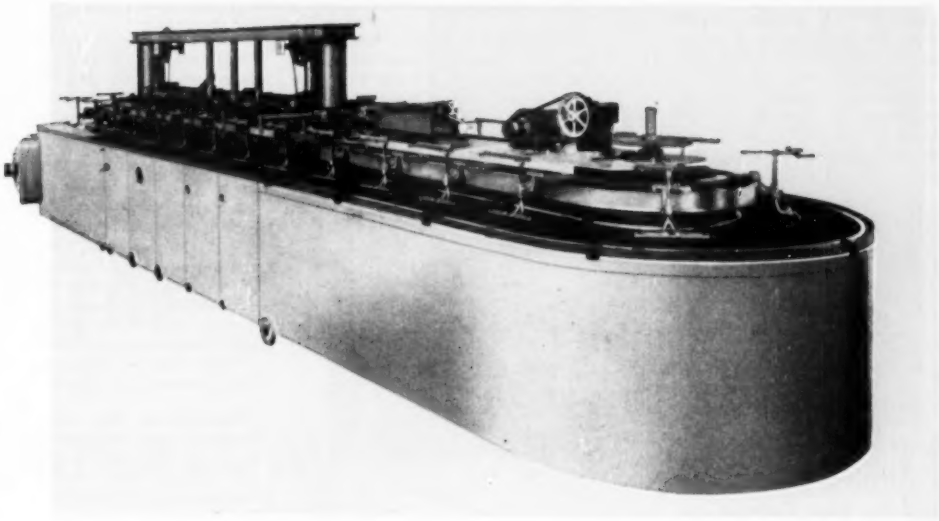
Late in 1950, the company started the construction of the second unit in the project, a 22,000-sq ft plant now in production, where the lines of Lea Liquabrade compositions; copper, cadmium and nickel brighteners, and Learok compositions are being manufactured.

Three more buildings are projected: (1) additional storage space; (2) compound plant; and (3) laboratory and office. No definite date has been set for their construction, but it is hoped that the entire project can be completed by 1955.

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Subscriptions: Domestic and Canada, $4.00 for 1 year, $7.00 for 2 years 50c per copy; Foreign, $8.00 per year $1.00 per copy.

CROWN TYPE "C" AUTOMATIC

for plating and cleaning . . .



STREAMLINE your plating operations — get a better quality of work at lower cost by installing Crown automatic equipment. You'll benefit immediately by a better control of production schedules — uniformity of plating — elimination of human variables and a reduction in plating costs.

Investigate the possibilities of Crown automatic equipment for your plating operation — give us details of your requirements for additional information.

TYPE "C" MACHINE — (up to 50 ft. lengths) can be shipped in operating order as per following specifications:

1. Two Units on standard transport trucks.
2. Maximum shipping dimensions per unit 26′ long x 6½′ wide x 7½′ high. (Above units will go through most plant doors and aisleways.)
3. Tanks 42″ deep.
4. Maximum effective area of racks 28″ long x 18″ wide.
5. Maximum treatment for given floor space.
6. High speed vertical agitation (up to 18 ft. per minute can be built into machine.)

CROWN RHEOSTAT AND SUPPLY COMPANY

3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 103.

Industry News

Wyandotte Representatives Watch Soak Cleaner Demonstrations. Thirteen Industrial, Railroad and Aircraft Sales and Service Supervisors of Wyandotte Chemicals Corporation recently witnessed a number of laboratory demonstrations, including applications of soak cleaners, during a week-long training school at the company's laboratories in Wyandotte, Mich.

They are: seated, J. W. Rapp, special railroad representative; George Hans Beeton, L. A. Dunn, Chicago; B. J. Rosenthal, Minneapolis; and A. S. Kiefer, Chicago; standing, Wallace Miller, Cleveland; Andrew Tiger, Head, Wyandotte Industrial Research Laboratories; Terence Neill, Vancouver, B. C.; B. C. Gertson, Los Angeles; W. B. Christensen, Minneapolis; W. S. Fernholz, Los Angeles; B. Noel, Pittsburgh; Robert Racine, Manager Industrial Detergents, Wyandotte; R. C. O'Keefe, Syracuse; E. J. Kubis, Technical Service Department, Wyandotte; M. O. Crawford, San Francisco and H. J. Baecker, Wyandotte Chemicals Industrial Research Department.

PERMAG
meets every cleaning demand in the industry. Fast positive processes for specific purposes. Approved and in constant use by leading electroplaters in America.
For Your Technical and Purchasing Index File
Electrolytic
PERMAG Cleaning Compounds
PURPOSE
a. Used to yield perfect cleanliness for electrodeposition.
b. Used to provide proper chemical and metallurgical cleanliness.
REQUIREMENTS
a. Must remove all soil.
b. Must be free rinsing.
c. Must develop no side reactions.
CONSIDERATIONS FOR SELECTION
a. Pre-treatment and soil considerations.
b. Process requirements.
c. Type and condition of metal.
Fifth in our series of Cards on Metal Cleaning with PERMAG. Note the important points covered.
MAGNUSON PRODUCTS CORPORATION
Mfrs. Specialized Cleaning Compounds for Industry
50 COURT STREET
BROOKLYN 2, N. Y.
IN CANADA: CANADIAN PERMAG PRODUCTS LTD., MONTREAL

The importance of assisting users of metal cleaners in setting up control procedures was discussed and demonstrated. Specific instructions for meeting the exacting metal-processing specifications of defense contracts were also stressed.

American Chemical Paint Company, Ambler, Pa., has recently undertaken a research program under contract with the Office of the Quartermaster General, Washington, D. C. The scope of the program will be the investigation and development of pre-paint treatments and final chemical treatments of metal surfaces for the protective finishing of designated Quartermaster articles of supply.

Harry Faigen of the American Chemical Paint Company is conducting the studies.

Pennsylvania Salt Manufacturing Company and Sharples Chemicals, Inc., announced that they have entered into an agreement whereby Pennsalt common stock will be offered in exchange for Sharples common stock at the rate of 5.15 shares of Pennsalt for one share of Sharples. It was expected that the offering would be made the latter part of December.

In announcing the exchange plan, officers of the two companies pointed out that combining the two businesses will further diversify both. Pennsalt has been engaged principally in the manufacture of inorganic chemicals but in recent years has been extending its activities into the organic field. Sharples has specialized in synthetic organics, none of which is presently marketed by Pennsalt.

Allied Research Products, Inc., 4004-4006 E. Monument St., Baltimore, Md., has announced the establishment of two new subsidiary companies.

The first, **Allied Metal Finishing Corporation,** will assume responsibility for the job-shop metal-finishing business previously conducted by the present organization. Offices will be maintained in the building owned by the parent company, and the sales and service staff will remain the same. The second subsidiary, **Allied Research Sales Corporation,** was established to handle the national sales of the Iridite metal finishes and ARP

RESINALL® METALITE® CLOTH BELTS

The preplating polishing of auto bumper guards becomes a high speed, low-cost production process with these RESINALL METALITE abrasive belts. With the right contact wheel, the belt easily adapts itself to the contours of the job. And with each aluminum oxide grain held securely in its original cutting position, like a lathe tool gripped by its tool holder, RESINALL METALITE Belts continue their abrasive action long after ordinary belts are worn out. No rubbing and no excessive loading, either. The heat-proof bond won't soften under the heat of continuous production finishing.

See this profitable production method in action. Our Field Engineers can show you in your own plant, or in a nearby BEHR-MANNING Demonstration Room. Make a date now.

NEW PACKET ON POLISHING

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Company _____
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FOR SELECTIVE PLATING

High Speed Copper
Cadmium
Tin
Zinc
Silver
Gold
Gold on Silver
Silver on Gold
Nickel
Chrome (Decorative)
Phosphate Coatings
Alloy Solutions

MICCROSTOP stop-off lacquer is the first lacquer to be developed that will hold a hair line of demarcation through boiling cleaners, acid rinses and all selective plating cycles. It permits a degree of accuracy that has never before been possible.

MICCROSTOP stop-off lacquer was developed by the Michigan Chrome and Chemical Company research laboratories from new synthetic resins. It has excellent dielectric strength – is absolutely neutral – will not contaminate any plating solution nor etch the finest polished or lapped surfaces. May be brushed, dipped or sprayed – possesses rapid air-drying qualities.

The plating industry has long needed this sure stop for stop-off – another MICCRO first.

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and Chemical Company
6340 East Jefferson Avenue • Detroit 7, Michigan

MICCRO

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plating chemicals. The parent company will continue to manufacture both the Iridite and ARP compounds and will continue new product research and development.

H. C. Irvin, President of Allied Research Products, Inc., was elected president of both subsidiaries at recent stockholders meetings.

True Brite Chemical Products Company, Oakville, Conn., is now being operated by Mr. Henry Strow, who was the Chief Chemist of MacDermid, Inc., Waterbury, Conn., and continues as its consultant.

The True Brite plant was recently enlarged, and new equipment was installed for the compounding of copper and brass plating-solution materials. The company will continue with present distributors and products and with the development of new products for the plating trade.

Automotive Rubber Adds Texas Plant. Acquisition of the former Texas Tank Company plant in Houston, Texas, is announced by Tim G. Meulenberg and Robert L. Redmond, co-founders and owners of Automotive Rubber Company, Inc., Detroit, Mich. Plans have been completed to operate the plant as **Arco Rubber Processors,** a division of Automotive Rubber Company, Inc. Structural alterations and installation of rubber processing equipment will start immediately, under the direction of operating men from the Detroit plant.

The new Houston operation, like the Detroit plant, will specialize in engineering, manufacture and installation of rubber-insulated tanks of all kinds, tank cars, exhaust systems, pipe and other production and plant equipment, as well as mechanical rubber parts.

MANUFACTURERS REPRESENTATIVE

Established manufacturer of patented, pressure-cooled buffing wheels wants representation now active in Ohio. Permanent basis only. Must have a following. Excellent opportunity. Write complete details.

Reply to:

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P. O. Box 168, Jenkintown, Pa.

FIELD ENGINEER

Highly experienced in all electroplating processes with emphasis on hard chrome. Must be experienced in customer contact and preparation of research and engineering programs. Mid-west location. Write: Alan W. Brown, The Cro-Plate Company, Inc., 747 Windsor St., Hartford 5, Conn.

Frederic B. Stevens, Inc., Detroit 16, Mich., at the National Metal Exposition, World Metallurgical Congress and National Metal Congress at the Michigan State Fair Grounds, Detroit, October 15-19, sold off the floor the huge Stevens Super "E" Barrel Plating and Processing Machine which was on exhibition. The machine, a continuous rotating-barrel-type machine which can be used for practically any metal-finishing process, as well as for cleaning and pickling, was shown to the public for the first time at the Metal Show.

ARE YOU CHEATING YOURSELF...

out of brighter, finer zinc and cadmium plating at lower cost by not trying the new ARP Plating Brighteners in your own plant? If you've not tried them call in your Iridite field engineer today for test samples. Or, write direct to

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REPRESENTATIVES IN PRINCIPAL INDUSTRIAL CITIES; West Coast: L. H. BUTCHER COMPANY

Manufacturers of Iridite Finishes for Corrosion Resistance and Paint Systems for Non-Ferrous Metals; ARP Plating Chemicals.

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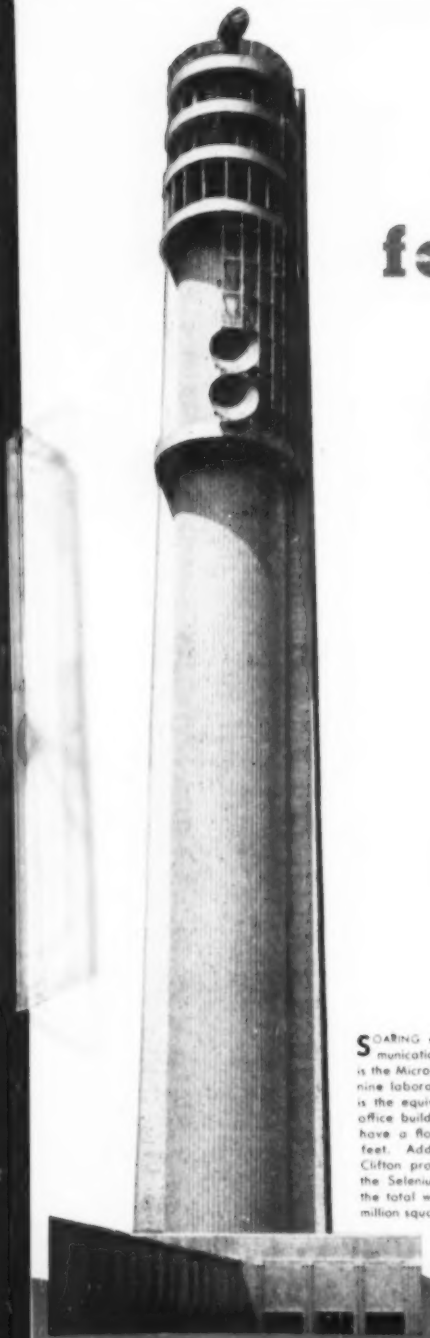


The for DEPENDABLE

Federal Telephone and Radio Corporation, the oldest and largest manufacturer of Selenium Rectifiers in the United States, devotes much of its tremendous plant and laboratory equipment and technical skill to the search for new ways and methods to serve business and industry. You users of Federal Selenium-on-aluminum Rectifiers in the giant electroplating industry profit through Federal's higher current overload capacities, efficiency, adaptability to varied atmospheric conditions, unique compactness and light weight. And, of course, where "time out" for adjustments often means a costly disaster, Federal offers *dependable* service and silent, unattended operation.

Illustrated is the 36-plate heavy duty stack supplied for use in the Wagner-Tiedeman Standard Electroplating Rectifier.

SOARING above the Federal Telecommunication Laboratories at Nutley, N.J., is the Microwave Research Tower housing nine laboratories of its own. In height it is the equivalent of a modern 32-story office building. The laboratories proper have a floor area of 138,000 square feet. Added to Federal's adjacent Clifton production plant, which includes the Selenium-Intelin Division, they bring the total working space to more than a million square feet.

INDICATE A 108.

FEDERAL TELEPHONE & RADIO — FTR — An IT&T Associate

Federal Telephone and Radio Corporation

100 KINGSLAND ROAD, CLIFTON, NEW JERSEY

UNBEATABLE COMBINATION

POWER RECTIFICATION

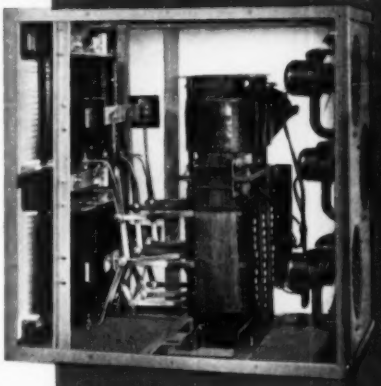
The Wagner-Tiedeman Electroplating Rectifier, a product of Wagner Brothers, Incorporated, is built around one sound policy: every claim, all ratings *must be conservative*. The company's development and production staff is proud of the W-T reputation as rugged, *trouble-free* equipment. The confidence of hundreds of critical plating men and plant engineers now depending on W-T Rectifiers as their source of DC power was won with *performance plus*—not with words.

For your own satisfaction, compare Wagner-Tiedeman feature by feature with any other rectifier made. Check with care:

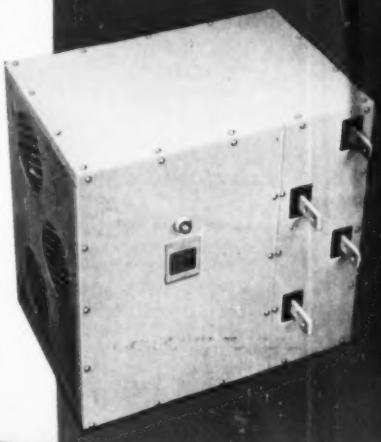
- Low First Cost
- Low Operating Cost
- Simplicity of Installation
- Simplified Maintenance
- Durable Construction
- Rapid Delivery

Our customers will tell you about W-T efficiency, flexibility, space-saving and trouble-free performance. Of course, the Selenium-on-aluminum stacks, made to Wagner-Tiedeman specifications by Federal, are the heart of the rectifier, selected as a result of continuous tests of all makes and years of confidence in Federal's ability to build a product satisfactory to the most critical Wagner customer.

Manufactured in all ***Standard*** *capacities*



Rear view, showing simplicity and ease of access



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Industry News

Crosscountry Clinic Sells Abrasives for Behr-Manning. Behr-Manning Division of Norton Company has evolved a way of showing off its own coated abrasives and sanding belts by exhibiting the latest developments in the abrasive machinery field. For this purpose, B-M is taking around the country a Grinding and Polishing Show. Held in B-M's own demonstration rooms, it is a lure a production man finds hard to resist.

The first big clinic was held in Boston this summer, the next one in Chicago. From there the show will move from city to city, coast to coast.

Behr-Manning has been doing this kind of clinic work on a smaller scale since the war. It set up 15 demonstration rooms attached to its branch warehouses and sales offices in various cities, plus headquarters in Troy, N. Y. Each demonstration room is equipped with the latest machinery of the kind that is used in that particular area. In Detroit, its machinery is for auto production; the Chicago clinic stresses metal finishing.

Industrial Films. The following films are lent free for group showing:

"Top Performance", is furnished by Yale & Towne Mfg. Company, 11000 Roosevelt Blvd., Philadelphia 15, Pa. This 22-mm sound motion picture in color makes use of circus motif to show how modern materials handling saves dollars, physical exertion of employees, time and floor space in all branches of industry and business. It covers gas and electric trucks, motorized stackers, platform and pallet trucks, hand and electric hoists.

"Conveyors That Pay Dividends", also a materials handling film, is lent by Lamson Corporation, Syracuse, N. Y. This is a 2-reel sound film covering typical conveyor applications in 14 different industries. The film illustrates the use of belt conveyors; a bottle-emptying device; deflectors; a central dispatcher for controlling adjustable conveyors; live-roll, incline, plant-wide overhead conveyors; limit switches; etc.

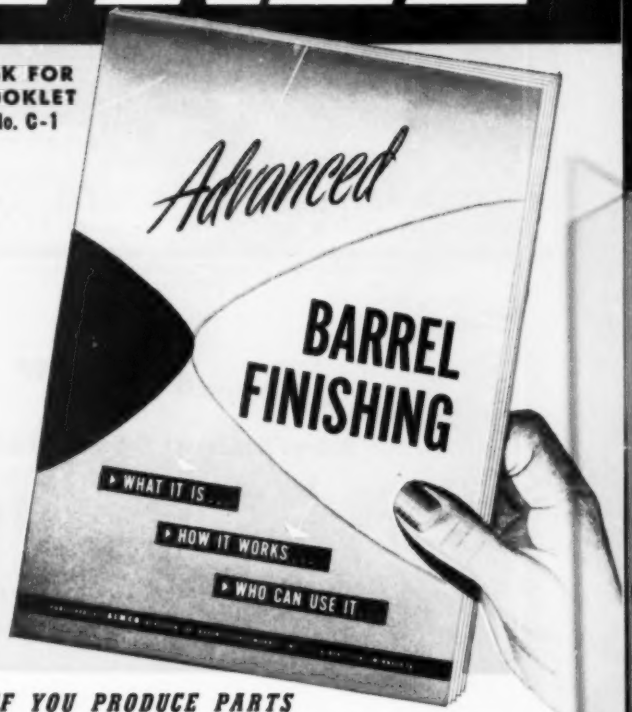
"Piping Pointers", is a pipe and valve film issued by Crane Company, 836 S. Michigan Ave., Chicago 55, Ill. This 30-min. 16-mm sound film dramatizes the information contained in the 32-page piping data manual under the same title.

SITUATION WANTED

Metal-Finishing Supervisor. Age 34. Desires new connection in supervisor capacity. Nine years' experience in production electroplating in the automotive field. Background includes installation and operation of plating and waste treatment equipment. Complete resume of personal data will be sent upon request. Fred G. Brune, 302 Bexley Avenue, Marion, Ohio.

FREE

ASK FOR BOOKLET No. C-1



IF YOU PRODUCE PARTS THAT REQUIRE FINISHING OF ANY KIND

This 22-page booklet is guaranteed to open your eyes! It gives you the inside story of advanced barrel finishing as never told before!

In the last five years, barrel finishing has made rapid advances. Only those directly connected have been able to keep up. Only 30% of the nation's manufacturers are benefiting from the tremendous cost savings and improved finishes made possible by these advances.

Now is the time to investigate this labor-saving, cost-cutting method. ALMCO barrel finishing equipment has completely paid for itself in as little as two months! This is easy to understand. A single unit installation replaces from two to twelve men. Savings run as high as 95%.

"Advance Barrel Finishing" is the only mass deburring, grinding and finishing method where results are controlled. Amazing results are now possible on almost all types of parts from large castings to small intricate parts. Close tolerance parts can be finished with absolute uniformity to almost any desired micro-inch reading.

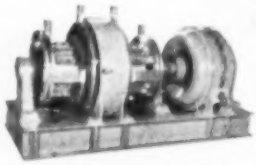
WRITE TODAY FOR YOUR *FREE* COPY

ALMCO Supersheen

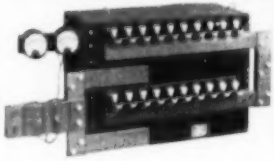
AMERICA'S LARGEST MANUFACTURER OF ADVANCED BARREL FINISHING EQUIPMENT — MATERIALS AND COMPOUNDS

ALBERT LEA, MINNESOTA

COLUMBIA



MOTOR GENERATORS
for Electroplating, Anodizing,
Electrocleaning, Electropolishing



TANK RHEOSTATS

- REVERSING SWITCHES
- TONG TEST AMMETERS

Write for Descriptive Bulletins

COLUMBIA ELECTRIC MFG. CO.
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We combined separate degreasing operations by using BLACOSOLV

Highest Stabilized Degreasing Solvent—BLACOSOLV is stabilized not alkalized—Years of research have produced this outstanding solvent. Contains no alkaline materials for the purpose of neutralizing acid *after* breakdown. Stabilizers prevent breakdown and possible acid formation. Blacosolv is the *one solvent* for *all metals* or *combination* of metals.

Write today for full information

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Gene's Plating Works, through Gene Neil, President, has announced the construction of a new plant in conjunction with the present facilities at 3498 E. 14th Street, Los Angeles. This expansion has been due to the increased demand for aircraft plating. One of the main features

of the new building will be a complete barrel-plating and ball-burnishing set-up with overhead Monorail System for zinc, cadmium and nickel plating.

American Air Filter of Canada, Ltd., Montreal, P. Q., will handle the Canadian business of the **American Air Filter Company, Inc.**, Louisville, Ky. Wm. G. Hole, formerly of Darling Bros., Ltd., will be in charge of all Canadian operations. Representation will be established in the larger Canadian cities to handle the AAF line of air filters, electronic precipitators and Roto-Clone dust collectors.

POSITION WANTED

Electrochemist, Ph.D., 15 years research and industrial experience in electrodeposition and metal finishing, thorough knowledge of all electroplating and electroforming processes, seeks responsible position

Reply to:
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P. O. Box 168, Jenkintown, Pa.

SALESMAN or SALES MANAGER

Reputable manufacturer and distributor of Plating and Polishing equipment and supplies, established 30 years, representing the most prominent manufacturers, requires a gentleman to act as Sales Manager. This party must be presently employed by a reputable concern in our line as salesman or sales manager and be desirous of making a new connection. The man we want is to act as Sales Manager and naturally must have the necessary qualifications. An excellent opportunity offered by a Midwestern Company. Reply by whom employed the last 10 years, how long by each, married or single, age, weight, height and if possible, include snapshot. All information will be held strictly confidential.

Reply to:
P-152-B, PLATING
P. O. Box 168, Jenkintown, Pa.

SEYMOUR
ANODES

HELP YOUR PLATING PROBLEM

When excessive sludge, peeling, porosity and brittle deposits spoil your work, start clean with new Seymour Anodes — Anodes you can depend on for consistently excellent results. Our well-equipped laboratory and experienced staff are at your immediate service for analyses and tests, at no obligation whatsoever.

A HANDY LIST OF SEYMOUR ANODES

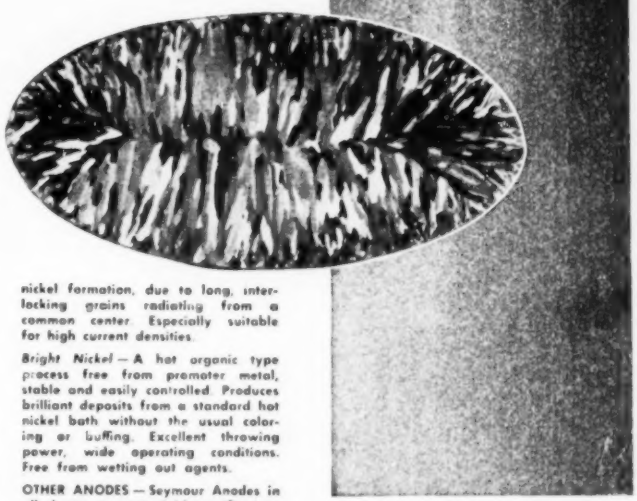
99%+ *Rolled Depolarized* — A very fine, homogeneous, even-grained virtually pure nickel anode. Corrodes in hot or cold solutions with minimum metallic loss. Forms practically no sludge. Especially suitable for baths having a pH above 4.5 electrometric.

99%+ *Rolled Carbon*—A rolled anode of high efficiency for low pH hot Watts baths not above 4.5 electrometric. Corrodes smoothly with a minimum of loose nickel.

99%+ *Cast Carbon* — A pure nickel anode with carbon content adjusted for smooth, uniform corrosion without special controls. Available, however, with carbon content to meet any specifications. Adaptable for general shop work using hot or cold baths.

95-97% *Sand Cast* — Corrodes readily in solutions low in nickel or weak in salts — therefore suitable for cold, high pH, low current density plating solutions. Uniform corrosion throughout the life of this anode is obtained by an even distribution of the carbon content. A 90-92% Sand Cast Seymour Nickel Anode is also available.

"Seycast" — An improved type of 99%+ cast anode of very high efficiency designed primarily for Bright Nickel baths, but works perfectly in any hot Watts bath having a pH of 4.5 electrometric or lower. Corrodes evenly with practically no loose nickel formation, due to long, interlocking grains radiating from a common center. Especially suitable for high current densities.



"Seycast"

Bright Nickel — A hot organic type process free from promoter metal, stable and easily controlled. Produces brilliant deposits from a standard hot nickel bath without the usual coloring or buffing. Excellent throwing power, wide operating conditions. Free from wetting out agents.

OTHER ANODES — Seymour Anodes in all shapes to meet rigid specifications are also available in copper, brass, bronze and zinc. The copper used is electrolytic. The zinc is always the best grade obtainable.

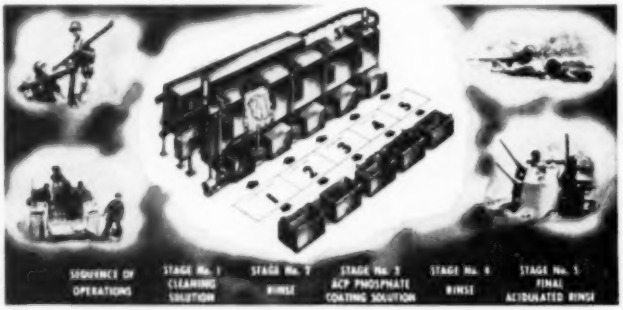
THE SEYMOUR MANUFACTURING COMPANY, SEYMOUR, CONNECTICUT

SEYMOUR

AMERICAN CHEMICAL PAINT COMPANY

AMBLER ACP PENNA.

Technical Service Data Sheet
Subject: METAL PRESERVATION AND PAINT PROTECTION WITH ACP PHOSPHATE COATING CHEMICALS


SEQUENCE OF OPERATIONS
STAGE No. 1 CLEANING SOLUTION
STAGE No. 2 RINSE
STAGE No. 3 ACP PHOSPHATE COATING SOLUTION
STAGE No. 4 RINSE
STAGE No. 5 FINAL ACTIDURATED RINSE

U.S. ARMY PHOTOGRAPHS COURTESY OF "ORDNANCE MAGAZINE"

Typical spray and dip phosphating equipment and some ordnance products that are now given a protective phosphate coating for extra durability under all kinds of severe exposure conditions. Both military and civilian applications of ACP phosphate coating chemicals are shown in the chart below.

SELECTION CHART OF ACP PROTECTIVE COATING CHEMICALS FOR STEEL, ZINC, AND ALUMINUM

METAL	ACP CHEMICAL	OBJECT OF COATING	TYPICAL METAL PRODUCTS TREATED	GOVERNMENT SPECIFICATIONS
STEEL	"GRANODINE" Zinc Phosphate Coating Chemical	Improved paint adhesion	Steel, iron, or zinc fabricated units or components, automobile bodies, refrigerators, washing machines, cabinets, etc. projectiles, rockets, bombs, rifles, small arms, bell links, cartridge cases, vehicular sheet metal, tank bolts and links, recoilless guns, etc.	MIL - S - 5002 JAN - C - 490, Grade 1 JAN - P - 645 U.S.A. 57 - B - 2, Type II, Class C U.S.A. 51 - 70 - 1, Finish 22.02, Class C U.S.A. 50 - 60 - 1 16 E4 (Ships)
	"PERMADINE" Zinc Phosphate Coating Chemical	Rust and corrosion prevention	Nuts, bolts, screws, hardware items, tools, guns, cartridge clips, fire control instruments, metallic bell links, steel aircraft parts, certain steel projectiles and many other components.	MIL - C - 16232 U.S.A. 57 - B - 2, Type II, Class B U.S.A. 51 - 70 - 1, Finish 22.02, Class B Navy Aeronautical M - 364 U.S.A. 72 - 53 (See An - F - 20)
	"THERMO-GRANODINE" Manganese - Iron Phosphate Coating	Wear-resistance, anti-galling, safe break-in of friction or rubbing parts, Rust proofing.	Friction surfaces such as pistons, piston rings, gears, cylinder liners, camshafts, tappets, crankshafts, rocker arms, etc. Small arms, weapon components, Hardware items, etc.	MIL - C - 16232 U.S.A. 57 - B - 2, Type II, Class A U.S.A. 51 - 70 - 1, Finish 22.02 Class A Navy Aeronautical M - 364 U.S.A. 72 - 53 (See An - F - 20)
	"GRANODRAW" Zinc - Iron Phosphate Coating	Improved drawing, extrusion, and cold forming	Blanks and shells for cold forming, heavy stampings, tube, tubing for forming or drawing, wire, rod, etc.	———
ALUMINUM	"ALUDINE" Protective Coating	Improved paint adhesion and corrosion resistance	Aluminum products of similar design such as refrigerator parts, mail box, signs, washing machine tubs, etc. aircraft and aircraft parts, hacksaws (rocket launchers), helmets, belt buckles, clothes dryers, clothesline, racket outers, etc., aluminum strip or sheet stock.	MIL - C - 5541 (See also QPL - 5541 - 1) MIL - S - 5002 AN - F - 20 U.S. Navad O.S. 675 16 E4 (Ships) AN - C - 170 (See MIL - C - 5541) U.S.A. 72 - 53 (See AN - F - 20)
ZINC	"LITHODINE" Zinc Phosphate Coating Chemical	Improved paint adhesion	Zinc alloy die castings, zinc or cadmium plated steel or components, hot dip galvanized stock, galvanneal, signs, siding, roofing, galvanized truck bodies, etc.	QQ - P - 416 RR - C - 82 JAN - P - 645 AN - F - 20 U.S.N. Appendix 6 U.S.A. 72 - 53 (See AN - F - 20)

CHEMICALS ACP PROCESSES

WRITE FOR DESCRIPTIVE FOLDERS ON THE ABOVE CHEMICALS AND FOR INFORMATION ON YOUR OWN METAL PROTECTION PROBLEMS

CHEMICALS ACP PROCESSES

Personals

Bernard C. Case is now Manager of Electrochemical Development of Hanson-Van Winkle-Munning Company, Matawan, N. J., and has transferred his activities to the Matawan laboratory from his position as field engineer at Detroit.

Case

Recently honored for his work as Vice-Chairman of the Research Committee of the American Electroplaters' Society, Mr. Case was until a few months ago Associate Editor of PLATING and has been active as Chairman of the Detroit Section of the Electrochemical Society, Chairman of Sub-Committee 3 of Committee B-8, A. S. T. M., and is an active member of the American Institute of Chemical Engineers.

Wilbur O. Zinn, President of the National Plating Company of Chicago, became "Electroplating's Man of the Year" of the Chicago Electroplaters Institute at its meeting on October 18 in the Electric Club, Chicago.

Carl Hansen, of Advance Tinning Co., Chicago, presents the plaque to Mr. Zinn

Mr. Zinn, 41, is a former president and now serves as a director of the National Association of Metal Finishers and has been active in the NAMF since 1946. He was instrumental in securing government and defense-program recognition for more than 2,000 member companies.

Dr. Raymond C. Machler has been appointed Director of Research and a member of the Executive Committee of Leeds & Northrup Company. He succeeds **I. Melville Stein,** who recently was elected to the newly created post of Executive Vice President.

A native of Evanston, Ill., Dr. Machler is a graduate of Northwestern Univer-

LEA Copper Glo

with the Ronal High Speed Bright Copper Plating Process*

TOPS in Brightness plus Throwing Power and Plating Speed

...are interested in bright ... production from existing equipment. If your ... one of obtaining a bright, soft copper with a min... of tank tie-up time, LEA Copper Glo can solve this in a way you cannot afford to overlook.

LEA Copper Glo gives you brilliance with exceptional speed of deposition and excellent throwing power. Its high speed plating characteristics (Hull cell bright current density range 10-60 amperes sq. ft. for standard formulations) permits production increases of from 30% to 60%, using existing equipment.

Plating minutes are valuable to you. Check up on Lea Copper Glo by the Ronal Process. In addition to brightness and high current density operation, it offers such added operating advantages as greater throwing power, ductile deposits, elimination of wetting agents and low copper concentrations.

* *The Ronal Bright Copper Process is a development of Ronal Chemicals Inc., Brooklyn, N. Y., for which process patents are pending.*

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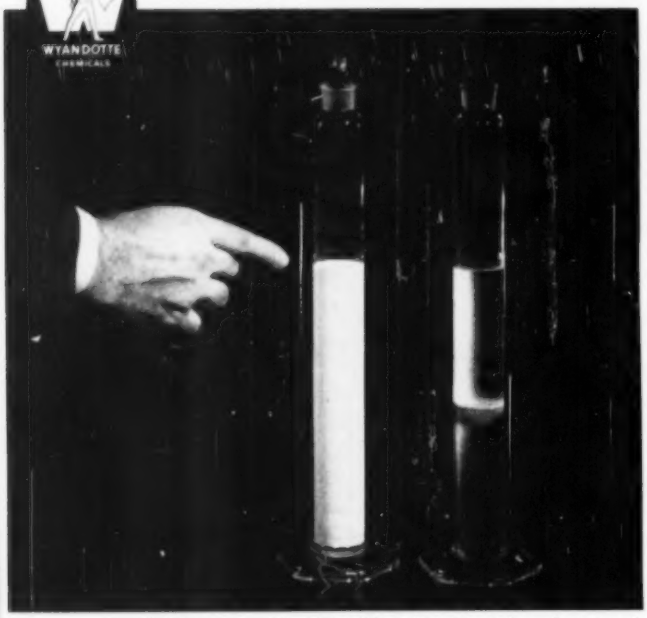


MK Emulsion—another helpful Wyandotte Chemicals product at work

Increase the life of your soak cleaners up to ten times

HERE'S *proof* that Wyandotte MK EMULSION vastly improves emulsification, has greater soil tolerance!

Compare the two graduates above. Note the amazing difference in emulsification!

In each case, 100 ml. mineral oil has been added to the solution. While the oil is only slightly emulsified in the graduate on the right, almost complete emulsification has been achieved in the solution to the left!

The difference is MK Emulsion

The same standard alkaline soak cleaner was used in each case. On the right, an 8-oz.-per-gal. solution of the cleaner was used. But on the left, the solution is 7 oz. of standard cleaner *plus* 1 oz. MK EMULSION *to the gallon.*

By substituting MK EMULSION for one-half of the soak cleaner used in the solution, *emulsification was vastly increased.*

Cuts cleaning time in half

This test *proves* that a small addition of MK EMULSION to your alkaline cleaner greatly increases soil tolerance. In actual production, as in this and other laboratory tests, MK EMULSION —(a) extends the life of an alkaline soak cleaner by as much as 10 times, and—(b) speeds up cleaning action, cutting cleaning time to as little as one-half the usual time!

Ask your helpful Wyandotte representative for further data. *Wyandotte Chemicals Corporation, Wyandotte, Michigan; also Los Angeles, California.*

CLEANING THE WORLD

Largest manufacturers of specialized cleaning products for business and industry

Wyandotte CHEMICALS

Helpful service representatives in 55 cities in the U.S. and Canada

Personals

sity, where he recived the degrees of B.S., M.A. and Ph.D. He joined Leeds & Northrup in 1929 as a research engineer and physicist and became Associate Director of Research in 1948.

J. C. Peters, Associate Director of Research, will be joined in that capacity by **G. A. Perley** and **A. J. Williams, Jr.,** both formerly Assistants to the Director of Research.

W. H. Webb has been appointed Sales Manager of Alkali Products for Detrex Corporation, Detroit, Mich. In the past ten years, Mr. Webb has advanced through the positions of Assistant Manager of the Alkali Division, Assistant National Accounts Manager, and Central Region Manager. He has wide experience in the plating and metal-cleaning fields.

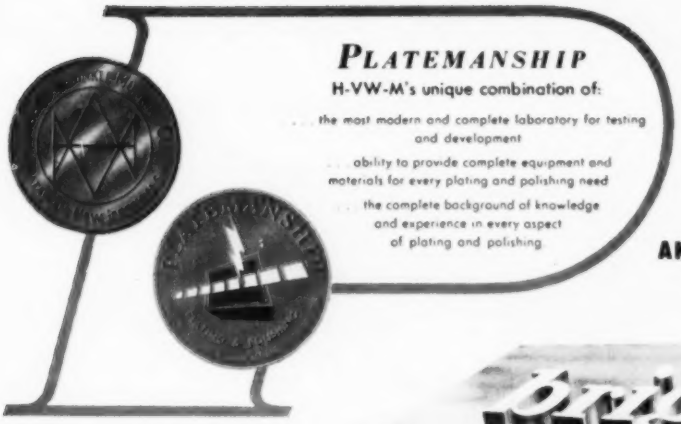
Webb

Roger C. Raduns, for the past six years supervisor of laundry sales and service for Diamond Alkali Company, Cleveland, Ohio, is now co-owner with **Walter E. Schlichte** of Chemical & Supply Company, 1311 S. Moody St., Tampa, Fla., distributor in Central Florida of chemicals and other products for the paint and plating fields.

Lindley S. Wood has been appointed direct-factory representative in New York State for United Buff Products Corporation, Passaic, N. J. His headquarters will be 1329 Bellevue Ave., Syracuse 4, N. Y. He has been well established in this area for several years.

H. Barden Allison has been appointed District Sales Manager of the Philadelphia Branch, Mechanical Goods Division, United States Rubber Company, succeeding **A. B. Means,** who continues as Sales Advisor.

A native of Philadelphia, Mr. Allison attended the Wharton School of Commerce and Finance, University of Pennsylvania. He joined U. S. Rubber in 1918 as a clerk in the mechanical goods branch in Philadelphia. He has held several important selling posts: from 1933 until 1947 as District Sales Manager in Cincinnati, Ohio; from 1947 as Sales Manager of the L. H. Gilmer division of the company.



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H-VW-M's unique combination of:

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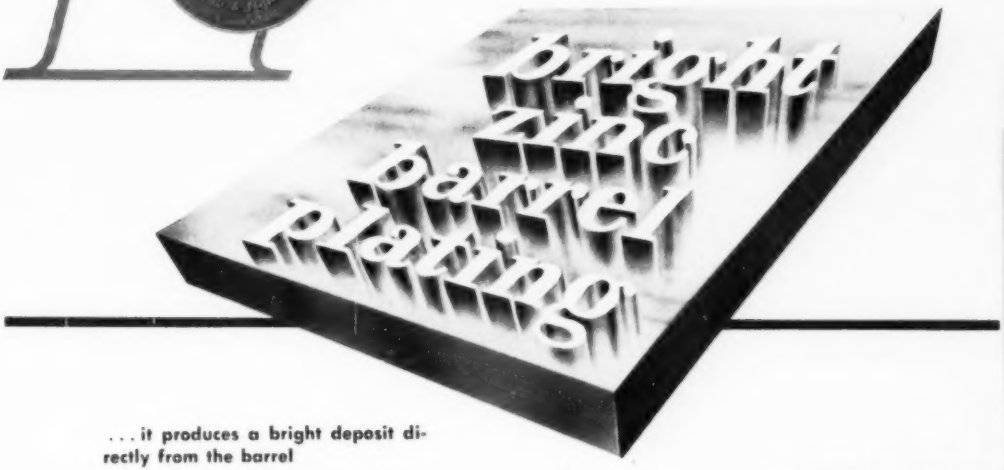
. . . ability to provide complete equipment and materials for every plating and polishing need

. . . the complete background of knowledge and experience in every aspect of plating and polishing

H-VW-M
PLATEMANSHIP
AND THE BBZ-200 PROCESS
PROVIDES



. . . it produces a bright deposit directly from the barrel

. . . it develops brilliant deposits over a wide range of current densities

. . . it eliminates need for subsequent bright dipping

. . . it has unusual tolerance for impurities

. . . it combines economy with simplicity

. . . it readily accepts conversion coatings and can be soldered with relative ease

BBZ-200, is an exclusive H-VW-M development. Its use in plating solutions permits zinc-plated parts to come flashing bright from the plating barrel. Finished products and parts plated by the BBZ-200 process not only *look* brighter, they *stay* brighter longer, have higher resistance to oxidation and tarnish. Low concentration of BBZ-200 Brightener in the bath plus low consumption add up to real economy in this outstanding process.

Virtually all cyanide solutions can easily be converted to obtain the superior results obtainable only with the BBZ-200 Process. The process is a typical example of *Platemanship*—H-VW-M's unique ability to meet and even anticipate every need of industry in all phases of pickling, polishing, buffing, anodizing and plating.

FOR COMPLETE DETAILS ON THE BBZ-200 PROCESS, SEND FOR THE TECHNICAL BULLETIN

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UNIFORM PLATING. Avoids defects, conserves costly, hard-to-get plating metal. Saves plating time.

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MORE PIECES PER RACK. Belke design with replaceable tips to keep every rack at full capacity.

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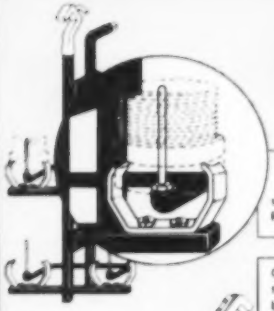
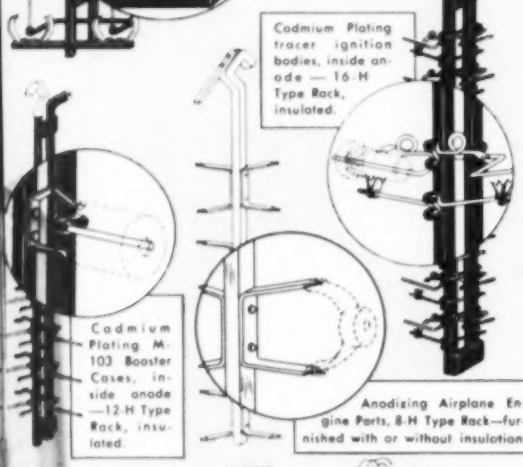
RESULTS TALK—

Send sample part with plating specifications for recommendation or ask us to send a Service Engineer.



Zinc Plating large round castings, inside anode—T Type Rack, insulated.

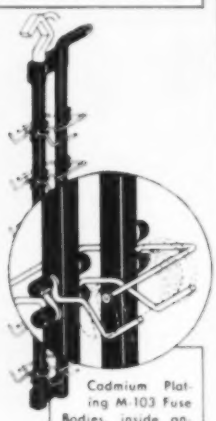


Cadmium Plating tracer ignition bodies, inside anode — 16-H Type Rack, insulated.

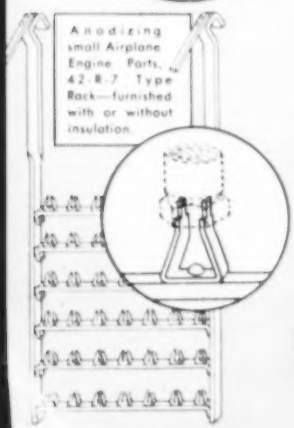
Cadmium Plating M-103 Booster Cases, inside anode —12-H Type Rack, insulated.

Anodizing Airplane Engine Parts, 8-H Type Rack—furnished with or without insulation.

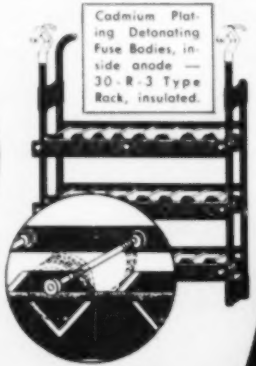
Cadmium Plating Fuse Liners, inside anode — 15-R-5 Cradle Type Rack, insulated.



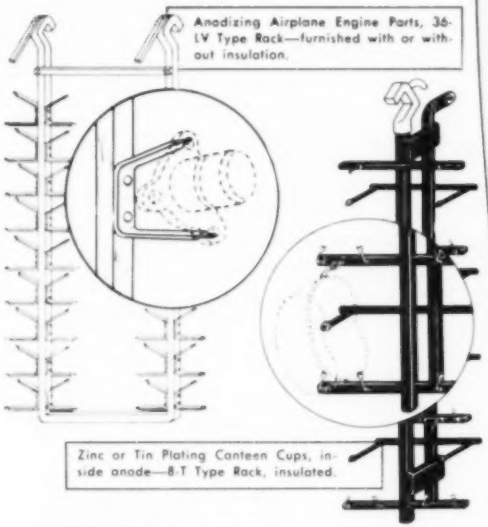
Cadmium Plating M-103 Fuse Bodies, inside anode — 12-H Type Rack, insulated.



Anodizing small Airplane Engine Parts, 42-R-7 Type Rack—furnished with or without insulation.



Cadmium Plating Detonating Fuse Bodies, inside anode — 30-R-3 Type Rack, insulated.



Anodizing Airplane Engine Parts, 36-LV Type Rack—furnished with or without insulation.

Zinc or Tin Plating Canteen Cups, inside anode—8-T Type Rack, insulated.

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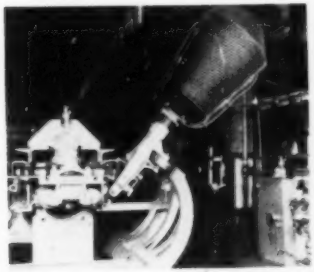
Trade Literature

L—712. Full Automatic Barrel Plater—The new "Stevens Super E" machine is described in a data sheet recently issued by Frederic B. Stevens, Inc., Detroit 16, Mich. Typical capacity in zinc plating is 1800–2000 lb of bolts and nuts per hour.



A feature is the automatic unloader shown here. For your copy, use Reader Service Card.

L—713. Packaged Electric Heaters—Edwin L. Wiegand Company, 7500 Thomas Blvd., Pittsburgh 8, Pa., offers a 4-page illustrated bulletin that covers its complete line of Chromalox "packaged" heaters—immersion, circulation, and other heaters that have built-in controls.

These ready-to-go heaters are said to be widely used in the plating, finishing, chemical, and related industries to maintain accurate temperature of plating solutions, super-heated steam, and melted soft metals. For your copy, use Reader Service Card.

L—714. Expansion Joints—A 4-page catalog containing over 78,000 possible combinations of bellows-type expansion joints has recently been published by the Solar Aircraft Company, San Diego 12, Calif. It serves as a reference handbook, and illustrates a diversified line of standard and special bellows assemblies, called Sola-Flex, used to take up expansion and contraction and offset movements in pipes and conduits. Sizes range from ½-inch to 72-inch pipe, pressures from vacuum to 1,000 pounds. Fabricated from stainless steel and a variety of heat and corrosion-resisting alloys, the bellows are said to find wide application in the chemical field. For your copy, use Reader Service Card.

L—715. Stainless Steel—A new 120-page cloth-bound data and handbook on stainless steels has been published by Allegheny Ludlum Steel Corporation.

Material in previous handbooks has been completely rewritten and categorized, and much additional information has been added. Approximately 40 different types of Allegheny Metal stainless steel are discussed from standpoints of analyses, fabrication, heat treatment, and special conditions of service.

The first seven chapters in the book are concerned with selecting the proper type of stainless for a given application. A selector table lists, for 30 types of nickel-chromium and straight-chromium steels, 40 properties: physical data, electrical properties, heat resistance, working and treating temperatures, mechanical properties, and creep strength. A second group of tables lists the corrosion resistance of the steels to various media, including organic substances, acids and salts.

Subsequent chapters discuss each type of stainless separately and in more detail, and supply specific information about heat treating, fabrication and certain special conditions in service. Separate chapters are given over to discussions of heat-resistance and low-temperature properties of the metals. For your free copy, write to the company's offices at 2020 Oliver Building, Pittsburgh 22, Pa., and mention PLATING.

SALES REPRESENTATIVE

An established manufacturer of Metal Finishing Equipment and Supplies is seeking a man qualified to represent them in western Pennsylvania, headquarters in or near Pittsburgh. In replying give age, marital status, employment history and other pertinent data. Include recent snapshot. This is an excellent opportunity. Information will remain strictly confidential.

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TRUE BRITE can now help your shortages of copper cyanide by concentrated solution of the double salts of sodium cyanide and copper cyanide. Reasonable prices and good materials are assured. Immediate delivery not assured, but attention will be given requests for information.

We also expect to have TRUE BRITE BRASS MAINTENANCE COMPOUND available in a concentrated liquid form and Makeup solutions for conventional brass plating. Write for information.

We still manufacture TRUE BRITE NICKEL BRIGHTENER and have plenty for immediate shipment. Still the best and most suited for subsequent chromium plating.

The TRUE INSULATOR is your best bet to insulate your steam and water lines from stray currents. Now available in ½, ¾, 1 and 1¼ inch sizes. Prompt delivery.

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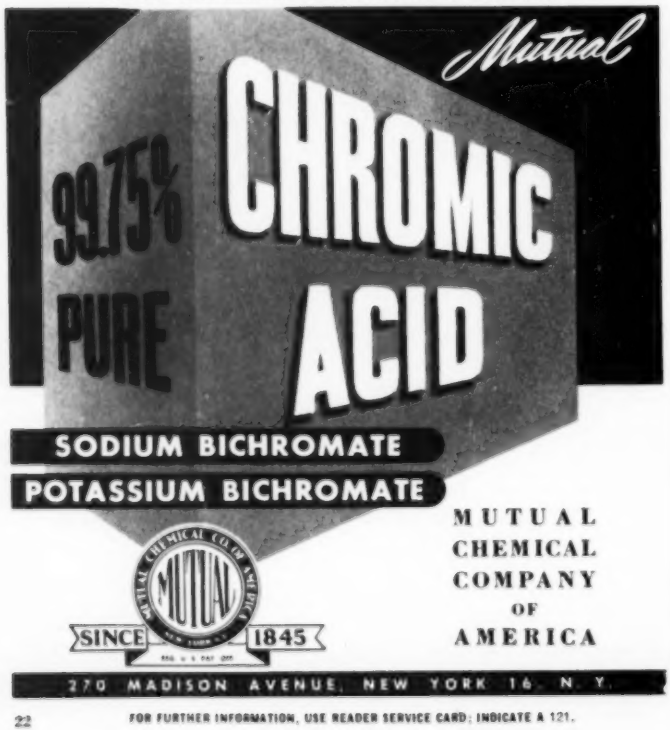
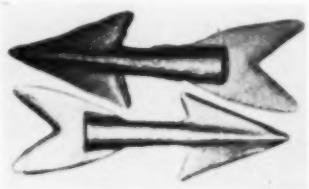


FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 121.

L—716. Barrel Finishing Compound—A special-purpose chemical for barrel finishing of brass, bronze, copper, gold and silver stampings, castings, machined and drawn parts is offered by Blue Magic Chemical Specialties Company, 2135 Margaret St., Philadelphia 24, Pa., under the trade name Blue Magic Compound No. 1 Double Strength. This compound is a highly concentrated paste for use in very small quantities and is said to yield uniform metallic colors and finishes in extremely short time cycles.



In Bulletin No. 1, it is recommended for finishing with or without media, and for roughing, deburring, cleaning and finishing in a single operation with selected nonferrous media. For your copy, use Reader Service Card.

L—717. Nylon and Teflon Forms—Polymer Corporation of Pennsylvania, Reading, Pa., in a 4-page bulletin, tells how to specify and order Nylon and Teflon in the form of rod, strip, tubing and slabs, as extruded, molded and cast. Fabrication methods and material characteristics are outlined. For your copy, use Reader Service Card.

L—718. "Frontiers of Personnel Administration"—This 160-page, 8½ x 11-inch book, sold by the Department of Industrial Engineering, Columbia University, New York 27, N. Y., is a report of the Conference on Industrial Personnel held at the University last March 19–23, and includes both papers and discussions. Among the topics are definition of personnel problems and, related to it, adjustment of line supervisors to new policies; organizational status of personnel executives; top managements self-rating on personnel policies; executive and super-

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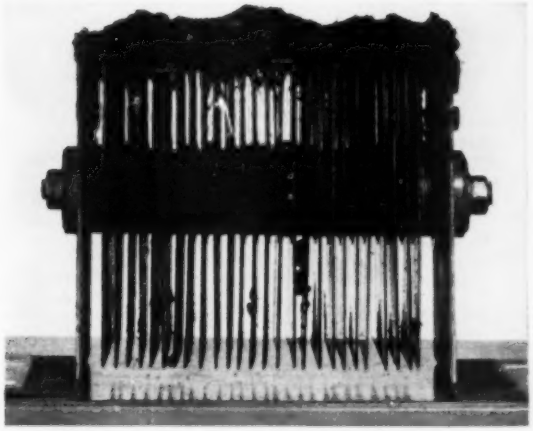
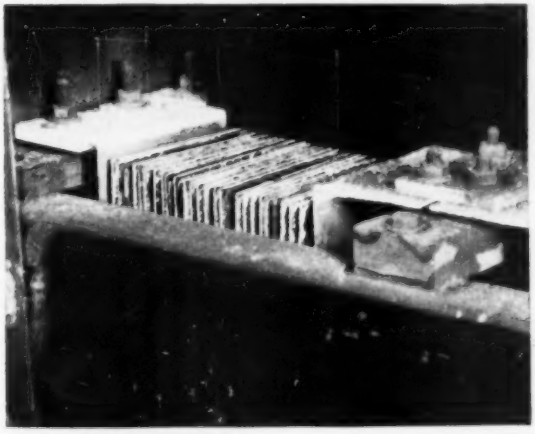
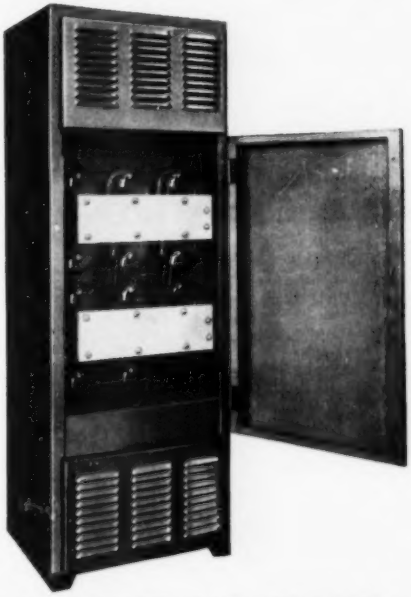


DIRT from sweeping and buffing operations has ruined this stack. The photo shows an unprotected stack removed from an ordinary plating rectifier which was in a poor location.



CORROSION damaged this stack which was placed too close to tanks. Fumes can impair open stacks in a short time if rectifier is improperly located.



G-E SELENIUM STACKS ARE SEALED IN OIL

Oil-immersed, hermetically sealed, G-E selenium rectifiers give you complete freedom of plating room layout. Place them anywhere, and forget about corrosion and dirt.

Stacks of G-E selenium rectifiers are factory sealed in oil-filled cans, with covers welded in place. Neoprene-sealed, glazed-porcelain terminals complete the seal—make sure that corrosion and dirt don't get in.

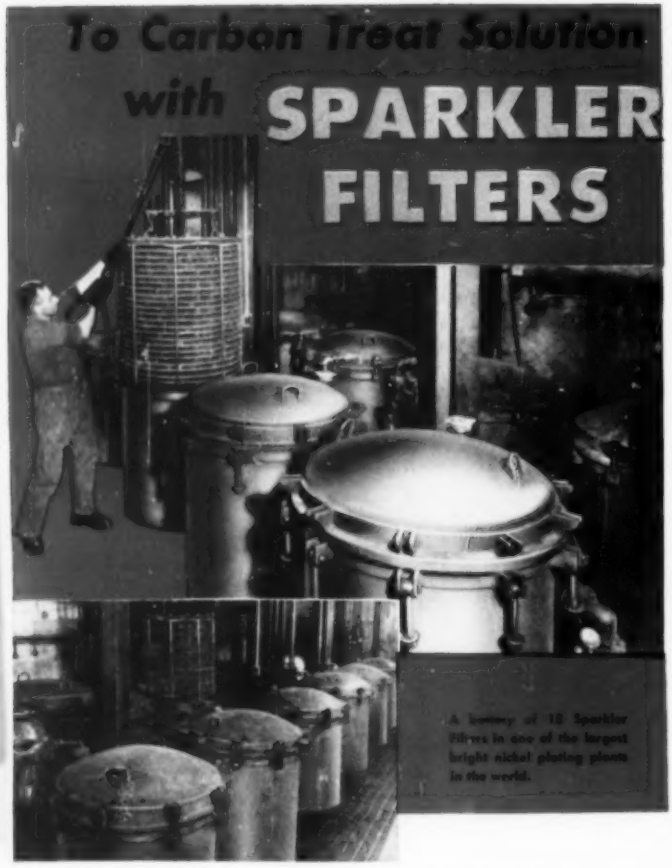
For real power savings investigate G-E rectifiers now. Contact the rectifier specialist at your local G-E office or write Section 464-6, *General Electric Company, Schenectady 5, N. Y.*

You can put your confidence in—

GENERAL ELECTRIC

464-6

NO SHUT DOWN



A battery of 18 Sparkler filters in one of the largest bright nickel plating plants in the world.

Carbon treatment without shut down is accomplished by cutting out one or two units in a battery of filters, removing the cartridge assembly of filter plates, and replacing with a new plate cartridge dressed with clean filter paper. The proper amount of carbon is mixed with water in a standby tank and recirculated through the filter thus depositing the carbon on the new plates in a cake of uniform thickness and density. The solution requiring a carbon treatment is then circulated through the carbon beds giving the plating solution the carbon treatment without contaminating the tank or stopping plating operations.

The quick change feature of the plate cartridge in Sparkler filters permits replacing a set of plates in a matter of minutes. Production can be resumed without appreciable interruption.

Sparkler Horizontal Plate Filters give absolutely sharp filtration at all stages of the cycle.

SPARKLER MANUFACTURING CO.
Mondelein, Illinois

SPARKLER horizontal plate FILTERS

Trade Literature

visory training; analysis of personnel problems and communication with workers (how to reach understanding); worker participation in increasing production; budgeting industrial personnel; interactions of men, materials and machines; personnel and the community. A newly compiled bibliography of over 1,000 items, classified under 23 subject headings, close the book.

L—719. Masking Method—A new Bulletin No. 160 describes pre-cut Quik-Masks made from "Scotch" brand pressure-sensitive masking tapes by the W. H. Brady Company, Dept. 387, 1602 E. Spring St., Chippewa Falls, Wis.

Said to be ideal for masking name plates, dials, gages, machined parts, holes, threads, engraved and embossed letters, plated and polished sections of any shape, the masks provide positive low-cost protection during spray painting, cleaning, plating, machining, tumbling, sandblasting, buffing, polishing, and many other production operations. They come pre-cut to the exact size and shape required, and are either mounted several masks to a card or individually with each mask having its own folded liner on the adhesive side. For your copy, use Reader Service Card.

L—720. Protective Coating—Coal-tar pitch has been compounded by a recently developed process into a fast drying protective coating by breaking it down into minute molecules, then combining it with water and a stabilizing emulsification agent to form a permanent suspension that can be brushed or sprayed.

Available from Flash-Stone Company, 30 E. Rittenhouse St., Philadelphia 44, Pa., under the trade name "Tarlac", it is said to dry to a tough, enduring, flat black film; retain all the protective and adhesive qualities of coal-tar pitch; to be impervious to oils, greases, other petroleum derivatives, acids, alkalis, water and condensation; and not to crack at low temperature or run at high temperature, being good from −56° to 200° F. It is recommended for concrete structures, masonry, etc., metals exposed to corrosive elements, mastic floors or other blacktop surfaces, wooden platforms and other wood exposed to the elements, also for other general protective purposes.

It is thinned when necessary with water, and covers up to 300 sq ft per gal. For a descriptive Bulletin, use Reader Service Card.

L—721. Infinity Graph Paper—Orbit Electric Company, 2710 N. Menard Ave., Chicago 39, Ill., offers free samples of Dylewski Arktan arctangent coordinate graph paper and of the Arktan Bulletin

CHROMATE OR BRIGHT-DIP PROBLEMS?

Call DAVIES—now exclusive Southwestern Distributors for famous IRIDITE PRODUCTS

The complete line of IRIDITE coatings will solve practically all problems in chromate conversion finishing of Zinc, Cadmium, Aluminum and the Cuprous Alloys. IRIDITE offers you:

- Peak corrosion resistance
- Lasting paint adherence
- Widest choice of colors
- Ease of application without special equipment

We particularly recommend:

- IRIDITE No. 1, 4 or 8-P for zinc and cadmium
- IRIDITE No. 14 AL-Coat for aluminum
- IRIDITE No. 7 Metcote for copper, brass and bronze

All IRIDITE finishes are approved under U. S. Government specifications and can be modified to meet your specific conditions. If present types are unsuitable, Allied Research Products engineers will gladly help develop special finishes.

Our service "shines" all over the great Southwest

Southwestern Sales and Service Representatives for these Famous Firms:

- THE UDYLITE CORPORATION
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- R. O. HULL & COMPANY
- INDUSTRIAL ELECTROPLATING COMPANY (Niehaus Fume Separators)
- MacDERMID, INC.
- TOPPER EQUIPMENT COMPANY
- FREDERIC B. STEVENS, INC. (Subsidiary of Udylite Corporation)
- ALROSE CHEMICAL COMPANY (Jetal Process)
- ALLIED RESEARCH PRODUCTS (Iridite)
- ALMCO DIVISION, QUEEN STOVE WORKS

—and many others

depend on DAVIES

the Southwest's leading supplier of industrial plating and polishing

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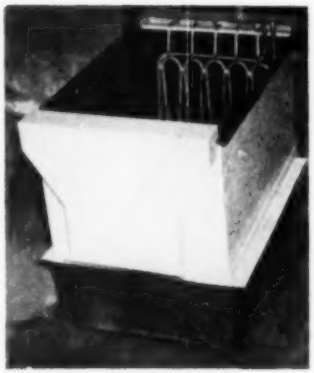
CHECK CORROSION WITH KOROSEAL
and conserve vitally needed steel

UNDER present conditions of steel supply you will find it slow going to replace a tank that's been ruined by corrosion. Play safe and fortify your tanks against attack. Mild steel tanks with Koroseal linings are giving fine service under numerous severe acid conditions. Such a tank, recently fabricated by Storts, is illustrated here—very inert to many strong oxidizing acids—yet it should not be specified indiscriminately. If you have a corrosion problem we should be glad to help with it.



42 STONE STREET — STORTS WELDING COMPANY INCORPORATED — MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 125.

Looking for a Better Finish?

Try

HARRISON'S

4A

TAILOR-MADE

BUFFING AND POLISHING COMPOUNDS

for

Aluminum, Brass, Copper, Stainless Steel, Carbon Steel, etc.

EMERY CAKE, GREASE STICK

CEMENT AND THINNER
for setting up wheels, belts and rolls

HARRISON & COMPANY, Inc.
HAVERHILL, MASSACHUSETTS

Trade Literature

describing its use for curve plotting in scientific, mathematical, engineering, and statistical analysis.

Arktan Form 1235 has one arctangent scale and one linear scale; Arktan Form 1236 has double arctangent coordinates. Their use permits the plotting of uninterrupted curves of data having values ranging from plus infinity to minus infinity and including zero as well. Most asymptotic functions become approximately linear in this coordinate system. For your copies, use Reader Service Card.

L—722. "Corrosion Resistance of Copper and Copper Alloys"—For twenty-five years the technical staff of The American Brass Company, Waterbury 20, Conn., has conducted laboratory research and field study of the nature of corrosive attack on copper and copper alloys. The results of these studies have been published now in a 24-page Anaconda Publication B-36, which explains the chemical and physical nature of corrosive attack in its various forms. Included is a tabulation indicating the relative corrosion resistance of the principal types of copper-base alloys when in contact with 183 different corroding agents. For your copy, use Reader Service Card.

L—723. Organic Coatings—A 4-page technical folder containing a quick reference index for quick determination of the most suitable coatings for rust prevention, chemical corrosion, and dampness is offered by The Wilbur & Williams Company, 130 Lincoln St., Brighton 35, Mass. For your copy, use Reader Service Card.

L—724. Setting Floor Brick—How to install floor brick and heavy tile to produce a floor with exceptional durability is the subject of a 4-page illustrated bulletin published by The Master Builders Company, 7016 Euclid Ave., Cleveland 3, Ohio.

Discussing the importance of narrow, tight joints in obtaining long life where corrosive conditions exist, this bulletin tells and illustrates how floors with joints down to 1/8 inch can be installed by using a readily flowable, non-shrink mortar produced with Embeco. It also gives complete specifications. For your copy, use Reader Service Card.

L—725. Polyethylene Plastic Products—American Agile Corporation, Plastics Division, 5806 Hough Ave., Cleveland, Ohio, offers a 4-page illustrated catalogue, "Agilene", that describes the Agilene grades of polyethylene and lists a variety of uses for these chemically highly resistant materials: bottles, jars, jugs, valves, pipe fittings, pipe, dipping baskets, fume ducts and hoods, plating barrels, and tank linings. For your copy, use Reader Service Card.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 126.

CYANIDE-FREE BATH!

SMOOTH COPPER—WITHOUT BRIGHTENERS!

CONSERVES COPPER!

MAINTAINS WIDE CURRENT RANGE!

another copper plating improvement

rounds out today's advantages of the
UNICHROME PYROPHOSPHATE PROCESS

■ More than ever, recently improved Unichrome Pyrophosphate Copper stands out as the bath with answers to many of today's plating room requirements. It has wide current density range —*and maintains it!* This helps keep plating output high by sustaining plating speed.

In addition, deposits are extra smooth, providing an excellent base for direct plating with bright chromium. Where smoothness of the base metal and quality requirements permit, it is sometimes possible to plate chromium without polishing this copper. If polishing is required, it is easily accomplished chemically or by buffing. The smooth, ductile Unichrome Copper deposit colors easily with no more than a light fanning. Therefore, you waste less copper on the wheel — minimize the danger of cutting through copper on sharp edges.

Containing no brighteners, Unichrome Copper is easier to control. With no cyanide, it greatly reduces your cyanide disposal requirements.

USABLE IN NICKEL TANKS!

Especially important to the plater substituting copper for nickel is the fact that Unichrome Copper, operating at 110° to 140° F, can be used in nickel tanks lined with rubber or plastic.

Write for new bulletin describing the many advantages of Unichrome Copper.

UNICHROME CHEMICAL POLISH 601 A quick dip in this solution brightens copper without banding or streaks. It is a simple, safe polisher, with great tolerance for copper. Saves buffing costs in preparing copper for chromium.

UNITED CHROMIUM, INCORPORATED 100 East 42nd St., New York 17, N. Y.

Waterbury 20, Conn.-Detroit 20, Mich.-Chicago 4, Ill.-Los Angeles 13, Calif.
In Canada: United Chromium Limited, Toronto, Ont.

UNICHROME Trade Mark

COATINGS for METALS

ZINC PLATING

For ULTIMATE BRILLIANCE And Best Results

Use ROHCO PRODUCTS!

ROHCO 100 AND 303 ZINC BRIGHTENERS

ROHCO 100 Barrel Brightener imparts brilliance to zinc plating that is almost unbelievable until observed. It exhibits high covering power so that recesses, usually unplated, are easily covered with a substantial thickness of deposit. ROHCO 303 Still Brightener gives unusually bright deposits that offer ideal surfaces for bright dipping to even greater lustre or for conversion coatings by chromic acid treatment. Minimizes consumption of bright dips. Also exhibits high covering power so that recesses are easily plated. The cost of ROHCO 100 and ROHCO 303 is far less than would be anticipated for the many advantages realized in uniformly highest quality, maximum production, and minimum labor costs.

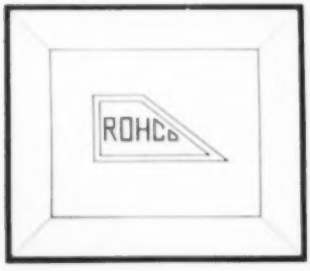
ROHCO ZINC PURIFIER

ROHCO Zinc Purifier keeps heavy metals precipitated and harmless to the bath. Used in the amount of only one pint per 500 gallons per day, either barrel or still, it minimizes consumption of zinc brighteners. Its cost is almost negligible.

ROHCO NO-FLASH

ROHCO No-Flash is used principally for barrel plating but may also be used for still plating. At a cost that is negligible, this product eliminates the hazard and nuisance resulting from gas explosions in zinc plating.

R. O. HULL & CO., INC.
1302 Parsons Court
Rocky River 16, Ohio
Canada: Armalite Company, Ltd.
Toronto 6, Canada



JUST PIN THIS COUPON TO YOUR LETTERHEAD!

R. O. HULL & COMPANY, INC.
1302 Parsons Court
Rocky River 16, Ohio

Gentlemen:

SEND { ..... Gal., Liquid, ROHCO 100 BARREL ZINC BRIGHTENER
..... Gal., Liquid, ROHCO 303 STILL ZINC BRIGHTENER
..... Gal., Liquid, ROHCO ZINC PURIFIER
.... Lbs., Powder, ROHCO NO-FLASH

Name .....
Company .....
Street Address .....
City ..... Zone ..... State .....

DIAPHRAGM
PLATING
Simplified
AUTOMOTIVE RUBBER COMPANY, INC. Detroit, Mich. U.S.A.
• Regardless of the type or size of your plating operation you will want a copy of this Diaphragm booklet. Discusses methods and illustrates equipment. Ask your plating supply dealer or write direct.
ARco
RUBBER PROCESSORS
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INCORPORATED
DETROIT • HOUSTON

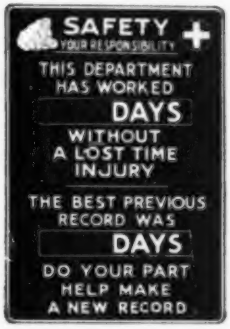
Equipment and Supplies

E—806. Cleaning Sludge and Muck from Oil Tanks—Bunker C fuel-oil storage tanks of all kinds tend to accumulate a particularly unpleasant deposit of muck and sludge which is also difficult to remove. Not long ago a new method was tried out, based on the use of Magnusol HD—an emulsifiable solvent cleaner, manufactured by the Magnus Chemical Company, Garwood, N. J., for removal of heavy, greasy dirt from metal surfaces. In this case, it was mixed with 10 parts distillate, and the mixture was sprayed through a large spray gun by a man clothed in safety suit, etc., while inside the tank. By the time he had covered all surfaces, the surfaces first treated were ready to be flushed off with water under pressure. No residues remained. For further information, use Reader Service Card.

E—807. Step Gage for Thickness of Iridescent Films—A new instrument for accurate measurement of the thickness of thin films, 2–16 microinches, by means of color comparisons, has been announced by the Special Products Division of the General Electric Company. It consists of a specially prepared glass plate enclosed in a plastic case. A film of barium stearate is deposited on the glass in a series of monomolecular layers, each layer having a thickness of 0.1 microinch. The successive layers are deposited in such a way as to build a series of steps. Each step is one microinch thicker than the preceding one.

When the step gage is illuminated by white light, each step reflects a color that is determined by its thickness. The steps, therefore, are seen as a series of colored stripes. For further information, use Reader Service Card.

E—808. Safety Scoreboard—Industrial Products Company, 2824 N. 4th St., Philadelphia 33, Pa., announces a safety-record sign designed to act as a constant reminder of days worked without a lost-time injury.



The IPCO Safety Scoreboard is 20 inches wide by 30 inches high, large enough to be seen at a distance. Attractively finished with green background and white letters, it features two blackboard panels with the word DAYS so that it may be kept up to date by marking in with chalk. For further information, use Reader Service Card.

E—809. Water Conditioner for Water Wash Spray Booths—The water used in water-wash spray booths must be properly conditioned to keep the paint floating and non-tacky. Pennsylvania Salt Manufacturing Company, 1000 Widener Bldg., Philadelphia 7, Pa., offers such a conditioner, Pennsalt PB-1. A booth employing it is said to stay clean longer—meaning fewer shut-downs for booth maintenance.

Pennsalt PB-1 also makes paint reclamation more feasible . . . several plants using it report successful salvage of pigments or whole paint for real savings in dollars and critical materials, at low cost. For further information, use Reader Service Card.

E—810. Masking Tape for Anodizing—Behr-Manning Corporation, Troy, N. Y., Division of the Norton Company, announces the addition of a new item to its line of Behr-Cat Brand Pressure Sensitive Tapes.

No. 113 Behr-Cat Brand Masking Tape has been developed especially for the difficult operation of masking off areas on anodized aluminum and magnesium as well as castings of these materials and their alloys, particularly where such parts

STOP OFF

FOR

ALUMINUM

A new Stop Off lacquer for use on Aluminum in selective anodizing, or in chemical treatments of this metal.

BUNATOL No. 796-CC Black is a quick air dry liquid that flows out easy and covers well. Air dries in 30 minutes to form a very adherent coating that is not affected by anodizing solutions or chemical solutions. Edges may be trimmed to a hair line, or lettering or designs may be exposed, and hold the edge perfectly. Applied by brush, spray or dip.

A single coat is all that is required for a good Stop Off film. This special lacquer covers a lot of surface, making it an inexpensive item to use in production. After running, the coating removes easily with a quick wash in Solvent. The Aluminum does not need any preliminary treatment other than removing surface dirt and grease, and must be dry. Just apply Stop Off, air dry and run the work.

No. 796-CC Black is made for use on Aluminum and of course does a better job. Time is saved—rejects eliminated and cost reduced. If your anodizing requires stopping off, get the facts about BUNATOL and a working sample. A note on your letterhead is all that is necessary.

BUNATOL

Manufactured by

NELSON J. QUINN, COMPANY

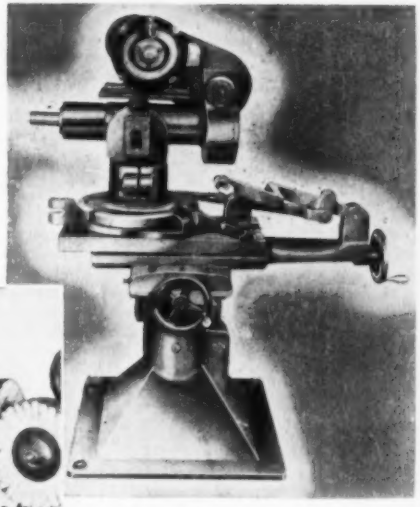
TOLEDO 7, OHIO

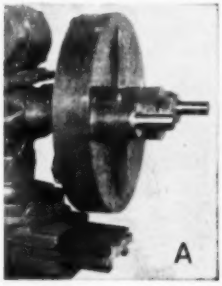
ACME Automatic Polishing and Buffing Machines

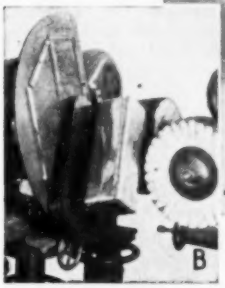
The ACME Type B-10 Semi-Automatic

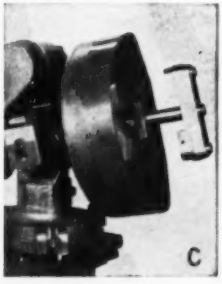
IS A VERSATILE PRODUCTION MACHINE

This machine gives very efficient production as one operator normally operates two or more units, one at each end of the lathe, loading and unloading one machine while the other has work in contact with the wheel.









A Type B-10 equipped with A-2 head handling parts up to 12" diameter. Vacuum chucking available.

B Equipped with Acme patented Geared Chuck which keeps rectangular or other out-of-round work in constant uniform contact with wheel. Two buffs finishing sides and top in one operation.

C Geared chuck for polishing or buffing faucet bodies. Production up to 240 pieces per hour, one man handling two machines.

This single spindle machine is used with the conventional lathe for finishing such cylindrical parts as cooking utensils, plumbing goods, electrical fixtures and appliances, reflectors, hub caps, automotive accessories, and numerous other parts.

Toggle slide, vertical and cross slide adjustments permit quick set ups when changing from one job to another. Additional accessory equipment can be furnished for finishing an unusual variety of out of round parts as well as cylindrical work.

CATALOGS ON REQUEST

ROTARY STRAIGHT LINE SEMI-AUTOMATIC AND SPECIAL *Polishing and Buffing Machinery*

ACME Manufacturing Co.

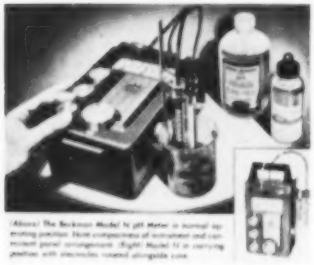
1400 E. 9 MILE RD., DETROIT 20 (Ferndale) MICH.

Builders of AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY

Equipment and Supplies

are to be subjected to high temperatures. For further information, use Reader Service Card.

E—811. Glass Electrode pH Meter—Beckman Instruments, Inc., South Pasadena, Calif., has announced the development of a battery-operated *pH* instrument incorporating a number of advancements.



Known as the Beckman Model N *pH* Meter, this instrument is light in weight, 4 x 6 x 9.5 inches in size, and said to be amply rugged to be used anywhere—in the field, in the plant, in shops, mills or laboratories—without dependence upon outside power circuits.

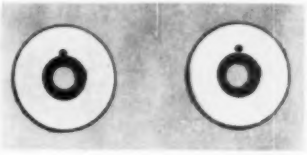
A rotatable electrode support is mounted on the side of the case to permit the instrument to be used in either a horizontal or a vertical position. The electrodes plug into the side of the instrument case, permitting quick interchangeability of practically unbreakable electrodes covering virtually the entire *pH* range from 0 to 14.

Two versions are offered. The Model N-1 is the basic instrument supplied complete with electrodes, buffer, KCl solution and beaker. The deluxe Model N-2 includes an auxiliary carrying case that folds up integral with the instrument itself to provide a portable unit containing all necessary accessories. For further information, use Reader Service Card.

E—812. Carbon Heat Exchanger—A newly designed heat exchanger, developed in Great Britain, is now available from the British American Carbon Corporation, 18 E. 48th St., New York 17, N. Y. The unit consists principally of a compact cube of "Delanium" carbon, a new elemental-carbon product. The heat exchanger is much smaller than a conventional heat exchanger of comparable performance, of rugged construction, and can be installed readily either singly or in banks. It is particularly useful with such corrosive liquids as most alkali and salt solutions, organic chemicals and all except the most strongly oxidizing acids. For further information, use Reader Service Card.

E—813. Barrel Finishing Compound—A special-purpose chemical compound for barrel-finishing of alloy-steel parts in minimum time is offered by Blue Magic Chemical Specialties Company, 2135 Margaret St., Philadelphia 24, Pa., under the trade name Blue Magic Steel Finishing Compound No. C-5.

The manufacturer states that with C-5 Compound and any generally used tumbling medium bright mirror finishes can be put on steel parts in 20–40 minutes.



Steel washer before and after burnishing for 2 hours with 5 oz Blue Magic Compound C-5 and 100 lb Alundum Tumbling Abrasive No. 6-T, with water level 2 inches above mass. Microinch reading reduced from 50 to 5

The compound can also be used in certain applications for both roughing and finishing to produce low microinch surface readings, true color and uniform results.

A non-dusting, soapy powder that has no obnoxious odor and is not irritating to the skin, the material is said to have out-

NOBLES CENTRIFUGAL DRYER increases production 200%*

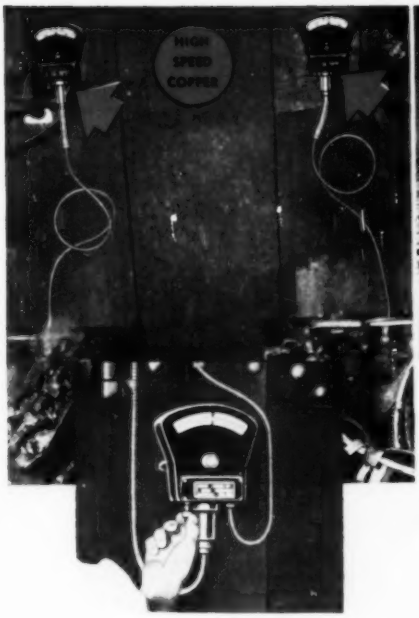
You can get results just as the Warsaw Plating Co. did by a simple conversion to NOBLES CENTRIFUGAL DRYER.

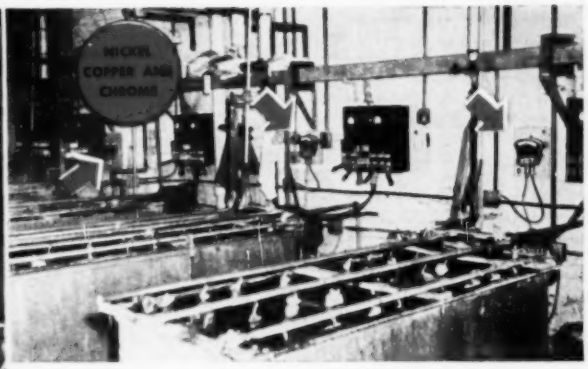
Features

SAFETY COVER
SEALED CHAMBER
CAST BASE
COMPACT
AIR EXTRACTOR
EXPANDING BRAKE
SEALED BEARINGS
REVERSIBLE MOTOR

Write for more information.

NOBLES ENGINEERING & MANUFACTURING CO.
645 EAST SEVENTH ST. ST. PAUL 6, MINNESOTA





YOU SET IT— SARCO *holds it!*

That seems to be the universal testimonial for Sarco LSI Electric Controls among plating men. "You see each batch is different" they say. "First we experiment—up or down a degree or two—just by turning the thumb screw. When we get it just right we tell the gang to leave it alone until the next batch comes along."

During the war, a battery of 22 high speed copper tanks illustrated at the left above, ran at 200°, 24 hours a day. "Temperatures cease to be a problem the day we put in Sarco Controls" they say. Today these tanks vary from 140° to 190°—depending on the work going through.

Imagine the advantages when you have nickel, copper and chrome all going at once. One inexpensive Sarco LSI on each tank does the job.

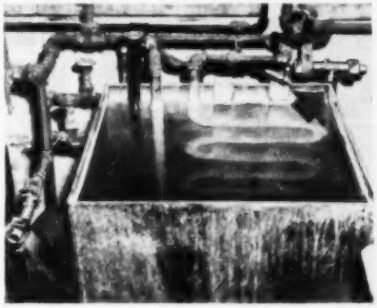
A WORD ABOUT COSTS

Perfect control affects all the elements in the cost of plating. Rejects the biggest item, are practically eliminated. Less heat is used because no heat is wasted. The amount of metal deposited is the same all day long—no waste in materials.

This Sarco Control can also be furnished for alternate heating and cooling used in chrome plating. Temperature is indicated at all times on dial cut for maximum visibility in your range.

Ask for Special Data on Plating Controls

Inexpensive Sarco 87 Trap-Control for Wash Tanks



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E—814. Tank, Rack, etc., Coating—Houghton Laboratories, Inc., Olean, N. Y., has started production of a broad line of plastisols and organosols. To make this possible, production facilities at both the Olean, N. Y., and Smethport, Pa., plants have been expanded considerably. The company expects to be able to supply both civilian and military requirements for these materials.

Marketed under the trade name Hysol, these plastisols and organosols are used as coatings for electroplating racks and tanks, dipping baskets, duct and pipe. For further information, use Reader Service Card.

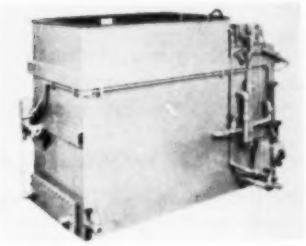
E—815. Barrel Finishing Material—Beaver Barrel Finishing Research, Lansdale, Pa., has developed two barrel-finishing materials. The first, called Igneous Lapcock, is a form of igneous rock that is said to do a splendid lapping job owing to its exceptionally uniform grain size. It is tough rather than brittle, and not easily friable.

The second is a Nine-Part Mineral Slurry, a pebble-milled combination of minerals, among which are detergent clays. In itself it is a mild abrasive, and when used in solution it holds any additive abrasive materials in suspension for constant action. For samples and further information, use Reader Service Card.

E—816. Plastic Goggle—Made of plastic by General Scientific Equipment Company, 2700 W. Huntingdon St., Philadelphia 32, Pa., this lightweight goggle (GS No. 100 Clear, GS No. 200 green) affords wide-angle vision and may be worn over

prescription glasses. One-piece construction with moulded rubber binding is said to fit natural contours of face. The elastic head band insures a snug fit and all-day wearing comfort. For further information, use Reader Service Card.

E—817. Solvent-Vapor Degreaser—A completely redesigned and improved model of Detrex hand-operated solvent-vapor degreaser is announced by Detrex Corporation, Detroit 32, Mich. The production cleaning machines included in this new series, VS-800, make use of nonflammable trichlorethylene or perchlorethylene. The usual cycle of operation is vapor cleaning, then flooding clean solvent over the work with a hand-held spray lance, followed by the usual pure-vapor cleaning phase.



A minimum of floor space, lower working height, and an efficient new-style solvent condenser are some of the improvements claimed. As the clean-solvent storage tank is built integral with the main machine body, the inside work space is cleared of all projections, including the solvent-collecting trough, condensing coils, and vapor-level-control bulb, and easy operation from either side of the machine is made possible. An improved corrosion-resistant coating, FF-1, is applied to all interior surfaces.

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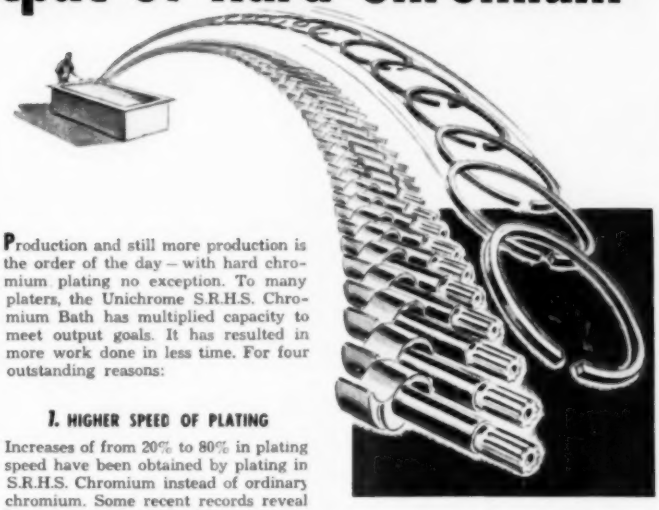
Four Features of Unichrome S.R.H.S. Chromium Bath

Increase Output of Hard Chromium



Production and still more production is the order of the day – with hard chromium plating no exception. To many platers, the Unichrome S.R.H.S. Chromium Bath has multiplied capacity to meet output goals. It has resulted in more work done in less time. For four outstanding reasons:

1. HIGHER SPEED OF PLATING

Increases of from 20% to 80% in plating speed have been obtained by plating in S.R.H.S. Chromium instead of ordinary chromium. Some recent records reveal that piston ring plating took 3½ hours instead of 5. Aircraft brake discs were done in 40 minutes instead of the former 65 minutes. Gun turret, engine parts and other defense production are being plated at a fast .0025" per hour rate.

2. CUTS FINISHING TIME, TOO

By its leveling action, the Unichrome S.R.H.S. Chromium Bath covers over minor irregularities in the base metal. In addition, the plate is smoother and there is considerably less tendency toward "treeing." As a result, the deposits need less grinding and final finishing. This can mean less need for excess chromium to allow for finishing and consequently more plating time saved.

3. INCREASED CAPACITY WITHOUT EXTRA EQUIPMENT

Because of higher cathode efficiency of S.R.H.S. Chromium, less power is needed to deposit the specified thickness of chromium on the work. In effect, the S.R.H.S. Bath increases generator or rectifier capacity by allowing more work to be processed without overloading the rectifier or generator.

4. SELF-REGULATION MINIMIZES CONTROL

This S.R.H.S. Chromium Bath needs minimum attention. Normally, it maintains itself in the peak "plating balance" that assures top throwing power and good coverage. This feature saves time, keeps the bath on the job, minimizes rejects.

United Chromium engineers are also ready to pitch in and show you how to meet specifications in less time and with less expense with a Unichrome S.R.H.S. Bath. Phone or write your nearest office of United Chromium, Incorporated.

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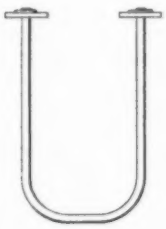
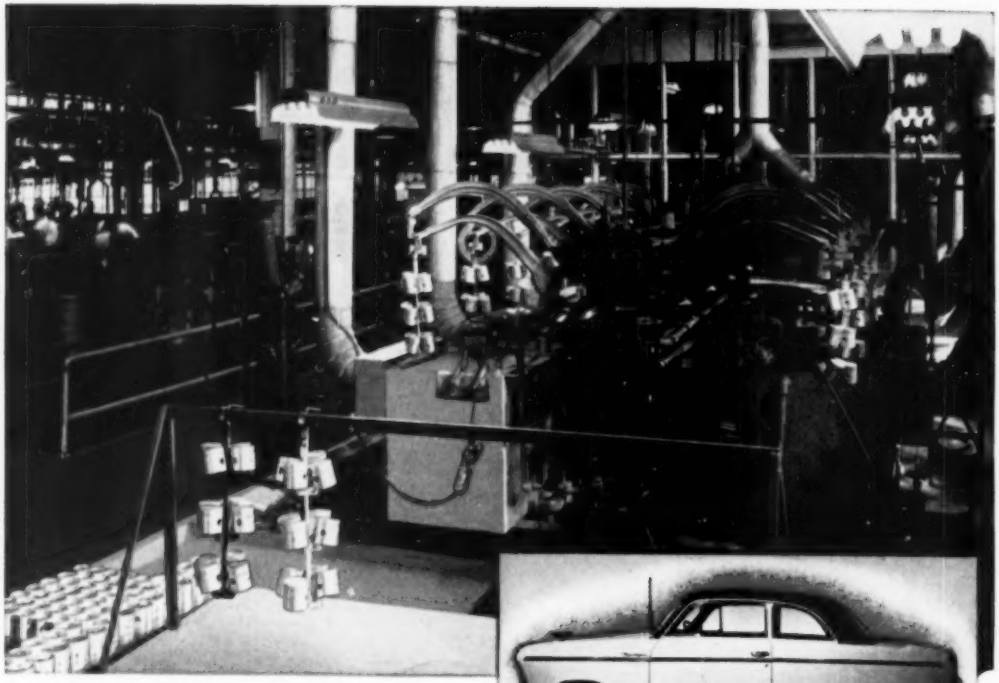


Acidproof Tantalum cuts costs in heating acid solutions

Acidproof to all plating solutions except hydrofluoric acid, the tantalum piping used in Unichrome Heat Exchangers and Coils has thin wall sections that promote more efficient heat transfer. Immune to attack, this tough tantalum heating and cooling equipment lasts longer, builds up no heat insulating deposits, and reduces servicing downtime to bed rock.

Bright Dip Finish with durability

Zinc plated products can be made bright as chromium by immersion in Unichrome Clear Dip. While this finish is in itself extra resistant to corrosion and staining, an application of a really tough clear enamel such as Unichrome Coating B-115 clinches quality. The non-yellowing, baking synthetic adds outstanding resistance to corrosion, handling and exposure. This combination finish offers the durability and eye-appeal needed to win sales.



Recently introduced, the new Willys Six is the newest addition to the renowned line of Willys-Overland automotive products.

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This month's cover picture shows an aluminum tray being oil polished prior to final finishing. Courtesy, Aluminum Company of America

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plating

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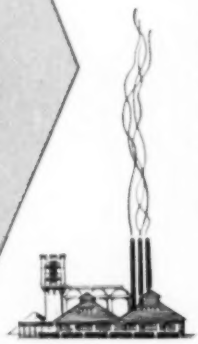

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Editorial

A.E.S. Research Through Foreign Eyes

ALMOST A FULL PAGE of the Metal Finishing Productivity Report reviewed elsewhere in this issue is devoted to the research program of the American Electroplaters' Society. The team of thirteen British specialists' comments on the competence of the direction, the low cost, the successful operation and the great benefits of the scheme. It suggests that British authorities explore the desirability and practicality of instituting a similar scheme with its immediate open publication of results.

J. J. Dale of the Defence Research Laboratories of Australia in his recently issued "Notes on Electroplating in U. S. A." also discusses the A. E. S. research program and mentions the considerable results of a useful nature that it has already produced.

Perhaps the best compliment that both the team and Mr. Dale pay the A. E. S. and the American plating industry is to call them "farsighted". In the past, American business was often, and justly, condemned for its shortsightedness in not preserving the country's natural resources. It is encouraging to note that its attention to the future, through research, is being recognized.

A. E. S. members, both active and sustaining, in the U. S. as well as in Canada, may take pride in what they have done so far and be emboldened to do even more in the future.

Gustaf Soderberg

Chromic Acid Anodizing Equipment and Its Practical Use

HERBERTH E. HEAD

Briggs Manufacturing Company, Detroit, Mich.

BRIGGS INSTALLED its first chromic acid anodizing plant in 1940. Since then we have added approximately twenty tanks. Averaging 20 ft in length, 7 ft in depth and varying in width from 4 to 40 ft, these tanks have a current capacity of from 1500 to 6000 amperes at 50 volts.

The Conner plant, where the original installation was made, has been used as the experimental plant, and practically all types of equipment were tried in that plant. The experience gained has been used to guide the choice of equipment in other Briggs' plants.

Current Generating Equipment

The heart of an anodizing plant is the low-voltage equipment. In the beginning we purchased three different types of rectifiers, namely, copper oxide, copper sulfide, and lead-selenium. We also purchased two different types of motor-generator sets: one type, a self-excited generator driven by a squirrel-cage motor; the other type, a separately excited generator driven by a synchronous motor, with a direct-connected exciter mounted at the end of the generator shaft furnishing excitation for both the motor and generator.

We have a recording voltmeter on all anodizing tanks. The charts from these instruments have shown that the synchronous-motor-driven generator has by far the most constant output voltage, a desirable feature in anodizing of aluminum for aircraft use. With the squirrel-cage-motor-driven generator or the rectifiers used, the slightest voltage fluctuation in the main line is reproduced, proportionately, on the low-voltage-output-voltmeter chart. The synchronous-motor-driven generator, on the contrary, draws a line as straight as if it were made with a ruler.

The matter of efficiency should also be considered when low-voltage equipment is purchased. One set of rectifiers that we are using has an efficiency of 60–70 per cent; another set, 50–55 per cent; and a third set, about 65 per cent. The synchronous-motor-driven generators have from 75 to 85 per cent overall efficiency. Consequently, we are replacing our rectifiers with synchronous-motor generator sets.

We have experienced very little maintenance expense with the generators; such has not been true with the rectifiers that we acquired.

Cleaning Equipment

It is considered good practice to vapor-degrease before anodizing to remove oil and grease from the parts before they enter the cleaner tank. The cleaner tank can be an ordinary steel tank, equipped with heating coils and ventilating hoods, much the same as any cleaner tank in a plating line.

The rinse following the cleaner tank can be an ordinary steel tank, supplied with heating coils to keep the rinse water warm. It does not have to be hot. With cold rinse water one is likely to encounter a film of grease that has been precipitated on the work by the cold rinse.

Anodizing Tanks

There is considerable difference of opinion as to the manner in which anodizing tanks should be lined up for maximum efficiency.

The tank used for chromic acid anodizing must be made of steel as the tank acts as the cathode in the circuit. Because of the relatively high voltage employed, it is imperative that the work be not permitted to short-circuit to the sides or bottom of the tank; that would cause a breakdown of the coating and would usually ruin the whole tank load of work. For this reason the tank's sides and bottom must be protected with insulating material.

Insulation

Originally we employed wood lattice-work, which was used to a great extent in the past. Wood is impractical for the following reasons: (1) it reacts with the chromic acid to form trivalent chromium, and the very rapid deterioration necessitates frequent, costly replacements; (2) quite often wood will swell and close the ventilation ducts, the workers will begin to have nose bleed, and there will be a visit with the shop committee, or even worse, a strike.

We have tried many other types of insulation. None of the plastics—and we have tried a number of them—stood up satisfactorily in our solutions. However, we have been advised that other plastics are available that might be satisfactory. Synthetic rubber also gave unsatisfactory results.

In our first experiment with ceramic-coated ex-

panded metal, we used 16-gauge perforated steel with one coat of porcelain-enamel ground coat; it held up for about 40 days. Next we tried one ground coat and two acid-resisting porcelain-enamel finish coats; it was in operation for over 6 months, and for a while we thought we had something worthwhile, as the perforated metal gave us maximum cathode action. Next we tried ¼-inch hammered wire glass; it did very well except for considerable breakage, which resulted in loss of time while the insulator was being replaced. We are now using sheets of "Herculite" heat-treated glass securely fastened around the sides of the tank and spaced about ¾-inch apart. This type of insulation does not prevent the tank from serving as cathode. The bottom is protected with a layer of acid-proof brick without cement joints.

Auxiliary Cathodes

Where auxiliary cathodes of steel are employed care should be taken to fasten them securely to the tank or to the rack structure, so that movement and contact with the parts under treatment be prevented.

Solution Agitation

Provision should be made, in the tank, to agitate the solution in order that the bath be maintained at an even temperature and that the chromic acid flakes dissolve rapidly when added to the solution. Air agitation will serve this purpose very well. A steel pipe, in which a number of holes have been drilled so as to shoot air out toward both sides of the tank in a slightly upward direction, can be placed near the center of the bottom of the tank. It should be laid on top of the brick lining so as to be easily removed for maintenance. Too rapid an agitation is unnecessary and likely to cause parts to short-circuit or become loose in the rack and thus end up in the reject pile.

Heating and Temperature Control

A word about temperature control of the solution. A thermal-control apparatus equipped with a recording thermometer is the most satisfactory. It operates two separate valves, by air or electric power. We have found it good practice to furnish the tank with coils on both sides and have steam and cold water running through the same coils intermittently. We are able to maintain the temperature within 1° F with such equipment.

Electrical Equipment

Besides the recording voltmeter mentioned above, it is advisable to install recording ammeters on all anodizing tanks. When that is done, one is able (1) to keep a close check on the loads and protect the low-voltage equipment from over-loads, and (2) to determine whether maximum production is being maintained at all times.

Chromic acid anodizing may be done not only in hand-operated tanks but also in semi- and full-automatic machines. Specially designed electrical control equipment is needed to hold down the current surge where full-automatic machines are used.

Racks

Caution should be exercised to minimize human contact with work in process. We use movable work racks on which the racked parts are hung before they are started through the process cycle. These racks can be moved by means of an electric traveling crane from the loading station right down the line, from tank to tank, to the inspection room. We use a number of these racks, so that all tanks can be kept full and working at all times.

Originally we wired all work suspended in tanks, but in the early part of 1941 we started experimenting with racking fixtures, with the result that almost all of our work is now being racked. This results in a considerable saving of man hours, electrical energy and chromic acid, and in a much better job. We are convinced that any part can be anodized on a properly designed rack just as well as, if not better than, when suspended by an aluminum wire. We cover our racks with a protective coating, thereby preventing unnecessary current consumption and effecting a considerable saving in chromic acid. In addition, the coating increases the life of the racks by a ratio of about five to one.

Any part of a rack that enters the anodizing solution must be made of aluminum, because copper or brass dissolve anodically in the solution, and steel draws such a high current that no one has sufficient generator capacity to do any anodizing.

Aluminum rack contacts must be cleaned, mechanically or chemically, each time they have been used because the contacts will become insulated by the anodizing operation. Filing is common for mechanical removal of the anodic film from the contact points. Chemical cleaning can be done effectively in either of the following solutions:

1.	Caustic soda	6 oz/gal
	Temperature	140–150° F
	Time	until gassing appears
2.	Phosphoric acid (85%)	5.6 fl oz/gal
	Chromic acid	2.8 oz/gal
	Temperature	boiling

The areas on the work which make contact with the racks are usually bare after treatment. Thus, the rack contact points must be kept as small as practicable. In designing the rack, one should avoid the possibility of formation of gas or air pockets on the work, which will prevent formation of the anodic film.

Anodizing Solution

As originally prepared the chromic acid solution contains 2.5 per cent by weight (3.3 oz/gal) of chromic acid. Standard commercial-flake chromic acid easily

(*Continued on page 50*)

SALES PROMOTION FOR THE JOB PLATING SHOP

RAYMOND GRUNWALD

President, Grunwald Plating Company, Chicago, Ill.

BUSINESS PROMOTION for the job shop plater presents a problem not always easy to solve.

We opened our plating plant in 1933 with 1,000 square feet of floor space, and 10 employees, and since that time have expanded steadily so that our facilities today cover 40,000 square feet and are worked by 150 men. We offer full-automatic equipment for polishing and buffing of all metals, including stainless steel and aluminum. Plating is done for both rust-proofing and purely ornamental finishing. The parts plated with copper, cadmium, brass, silver, zinc or otherwise finished are dried by the centrifugal process or in infra-red-drying ovens.

In our business we have nothing to sell to the general public. Thus, the common media of advertising which are so effective in most industries are not for us.

We like to feel that our business has grown because of the things our customers say about us. And the fact is word-of-mouth advertising of this desirable kind has brought us many of our new accounts.

There are, however, at least two other sales-promotion methods which we use profitably and which are available to all platers no matter where they are situated: classified telephone directories and sales training.

The Telephone Directory

We used a small display ad in the Chicago classified right from the start. We were counting pennies in 1933, but we wanted big circulation, too. Two years later, we splurged. We took a full-page ad in the directory, something one could do then. Our competitors thought we had taken a drastic plunge. As a matter of fact, we thought so, ourselves.

Today, under the heading, "Platers", we have a half-inch ad which mentions some aspects of our service, but also refers to our quarter-page advertisement which appears on the first full page of the "Platers" section of the book.

There is a Grunwald display ad of 2.5 inches along with bold-face listing under "Rust-Proofing". Under "Metal Finishers", we have a similar bold-face listing.

It goes without saying that we would not use this number and variety of insertions if it did not profit us to do so. We have traced leads to each one—some of these leads producing some very fine business indeed. The most helpful of the listings we have found to be under "Plating". That's where our biggest ad is placed, and we get our share of orders from big corporations because they go by the size of the ad.

This should continue to be helpful in securing rearmament orders in the months ahead. Many of our present customers are large firms turning more and more to defense work, and our past relations with them and the directory advertising are a good combination in securing sub-contracts. We know for a fact that the directory has helped Grunwald get attention in Chicago's big television-manufacturing industry.

We have no interest in building the business of the telephone-directory people, but we do find that a quarter-page ad is not merely two times as valuable as an eighth of a page. It is worth considerably more than that to us. Undoubtedly, still larger space would be better yet, but advertisers are restricted to a quarter-page in the Chicago directory. We would take a full page ad under "Platers" if that were possible, and we wouldn't say so if we didn't think it would pay in volume of business.

Hundreds of companies in the plating industry neglect almost completely the proper use of the telephone directory. In sales promotion, techniques are different when it's a service instead of a product being sold. For example, we experimented during the last war and bought some local radio time. But we couldn't advertise "specials" like a hardware dealer. Results would have been different if we had had tools to sell.

Training of Salesmen

Another aspect of sales promotion to which we have given much thought is the selection and training of salesmen. They must have some familiarity with the principles of chemistry and metallurgy, and this background of theoretical knowledge is important to their success in following up requests for estimates and in making calls. There's no substitute for knowing the language of the trade. We don't want them to become confused when an informed buyer asks a simple question about, say, the adhesion of one particular metal to another.

Obviously, the man who combines both technical knowledge and salesmanship represents the ideal, but it is a hard combination to find. If he has been a salesman, he has to be taught plating before he is sent out; if he has been a plater, he must be taught salesmanship.

ELECTROPLATING of Gold Alloys

EDWARD A. PARKER

Technic Inc., Providence, R. I.

(*Concluded from the December issue*)

Green Gold

Green golds, as such, have not been in popular favor for at least two decades. There has been a small demand for it in two- and three-tone work, e. g., in order to simulate green leaves on flower sprays. The statement that there has been little study of gold alloys goes doubly for the green golds.

Basically, silver or cadmium are added to a 24K gold solution until the desired color is produced. Just why the addition of these white metals to yellow gold will produce a green has always been a mystery. Probably the answer lies in the distribution of the light reflectance for the two metals over the wide span of visible wavelengths.

The addition of other white metals to gold solution, no matter how carefully done, has never produced a good green color. Zinc will produce a pale, weak green, and further additions pale out the color still further instead of intensifying the green. Within a very narrow range of temperature and concentration, the addition of nickel will produce a very slight green cast. Some call this color a greenish Hamilton. It is somewhat fugitive. Further addition of nickel will produce first a very pale yellow and then a white gold. Tin has no effect, and only pale yellows are obtained. If the gold content is low, white golds are plated.

One recommended formula is:

Gold, as $KAu(CN)_2$	2.0 g/l (5 dwt/gal)
Silver, as $KAg(CN)_2$	0.2–0.4 g/l (0.5–1.0 dwt/gal)
Free cyanide, KCN or NaCN	15 g/l (2 oz/gal)
Disodium phosphate, $Na_2HPO_4 \cdot 12H_2O$	15 g/l (2 oz/gal)
Temperature	150–160° F (66–71° C)
Current density	10–30 asf (1.1–3.2 amp/dm²)
Tank voltage	usually 4–6 volt
Agitation	none
Anodes	stainless steel, 2 x cathode area

Comparison with other formulas[23–27] indicates that in order to operate at lower temperature, from room to 130° F (54° C), it is necessary to raise the concentration of silver or cadmium or both from two to five times. Also, solutions containing higher concentrations of base metals are operated at lower current density, some as low as 1 asf (0.1 amp/dm²).

At the given operating conditions, further addition of silver only dilutes the green color, until finally a white gold with a green cast is obtained. With other conditions the same, a lower temperature also weakens the green color.

Most of the earlier literature specifies that the concentrate be prepared by dissolving a green-gold anode (14 or 18 K) in a divided cell. A given weight, such as 4.0 g/l (10 dwt/gal)[28–29] was dissolved in 30 g/l (4 oz/gal) of sodium or potassium cyanide as the initial electrolyte.

Use of such concentrates or of the anodes themselves, however, soon leads to pale, off-shade deposits. An electroplate of the required green color from a new bath will analyze 18–20K, or 75–84 per cent gold, whereas the original anode or the metal composition of the solution was 14K, or 58 per cent gold. After some use of the solution, its base-metal has increased considerably and the gold-base metal ratio has dropped below its optimum value. The resulting color is pale or reddish depending on the composition of the original anode and the plating conditions, i. e., free-cyanide content, temperature, etc.

A trick used by old-time platers to produce a very deep green from the above-mentioned solutions was to add a trace of arsenous oxide. The amount was never measured, but judged from the amounts added to pro-

duce a green-gold smut it was probably of the order of 0.01 g/l (0.0013 oz/gal) or less.

In two- or three-tone work, such as a combination of white, pink and green golds, it is the usual practice to put the green gold on last. The procedure might conceivably be: heavy nickel plate, rhodium plate, stop-off of final white areas with suitable lacquer, plate with pink gold, stop-off of pink areas, plate with green gold, strip stop-off paints in solvents, clean and treat with antitarnish materials. All rinsing and drying operations are to be used in their proper sequence.

White Gold

Electroplated white-gold finishes have never enjoyed much success. This is caused, in large part, by the poor finishes supplied before 1930.

Rhodium, a member of the platinum family, was introduced shortly thereafter, and its brilliance, whiteness, and non-tarnishing properties, together with the relative ease with which it can be plated, made it such a good substitute that it became the favored finish. The demand for white-gold electroplate has been negligible ever since, even though there are several good plating solutions at the present time.

The earliest mention of white-gold plating was in the book by Watt and Philip, which records a bath patented by Record (1834) containing equal weights of gold and nickel (10 dwt/gal; 4 g/l). No further mention is made of white-gold-alloy plating until the late twenties. In the meantime, flash plates of silver, tin, or nickel were used. Even as late as 1933 a question pertaining to white-gold plating sent to a trade journal was answered by suggesting a flash plate from a solution of stannous chloride in cyanide. In the twenties there appeared many questions in THE MONTHLY REVIEW from A. E. S. members in the jewelry or decorative fields concerning the possibilities of plating a good white gold.

The first actual white golds were deposited from solutions containing an excess of silver, cadmium or zinc; however, they did not age very well, soon producing dark and streaky plate.

Gold-alloy solutions containing nickel or tin or both have slowly evolved, until now fairly satisfactory solutions for white golds are available. Some of the earliest solutions were reported in 1930–1931, by Blum & Hogaboom[23] and Sizelove[24]. Both specified the use of nickel. Kersten[25] was granted two patents in 1933 for white golds. One was a gold solution saturated with nickel formate, and the other prescribed the addition of potassium stannate and a ratio of tin to gold of 2:1.

Typical formulae for tin-gold- and nickel-gold-alloy baths are as follows:

	Tin-Gold	*Nickel-Gold*
Gold, as $KAu(CN)_2$	0.4 g/l (1.0 dwt/gal)	0.6 g/l (1.5 dwt/gal)
Tin, as $Na_2SnO_3 3H_2O$	1.5–2.0 g/l (3.7–7.6 dwt/gal)	.....
Nickel, as $K_2Ni(CN)_4$	.....	1–2 g/l (3.8–7.6 dwt/gal)
Free cyanide, NaCN	7.5–15 g/l (1–2 oz/gal)	
Disodium phosphate, $NaHPO_4 12H_2O$	.....	15–22 g/l (2–3 oz/gal)
Temperature	150–160° F (66–71° C.)	
Current density	30–50 asf (3.2–5.4 amp/dm²)	20–50 asf (2.2–5.4 amp/dm²)
Tank voltage	6–8 volt	5–6 volt
Agitation	none	
Anodes	stainless steel, 2 x cathode area	
Time of plating	10–20 sec	10–180 sec

In the gold-nickel-alloy bath, the minimum nickel content is twice that of the gold, and the most satisfactory plate will assay 18–21.5K (75–90 per cent of gold). In the tin-alloy bath, the minimum tin content is four times the gold content, and the final plate will assay 12–16K (50–67 per cent of gold). Larger amounts of base metals will cause considerable grayness or matte plate or both. In fact, Raub and Bihlmeir[24] list their gold-tin formula as producing a dark-gray plate because a plate containing 30 per cent tin still has a yellow cast. Their higher tin alloy, however, is easily buffed to a high finish, as would be expected of such soft metals.

Antique Golds

Strictly speaking, antique golds are not alloys but loose combinations of metal crystallites, their oxides, hydroxides and basic carbonates. In brief, the plater has to produce in a few minutes an appearance which nature takes many years to create. The ultimate is to produce a true "heirloom" effect.

To do this the plater takes advantage of everything that is considered bad practice in bright plating. The most direct approach would be to produce a deposit that is dull or rough or both at low current density and a bright deposit at high current density. Unfortunately, the reverse effect predominates. Therefore, the usual process is to deposit a bright, adherent plate first and then allow the smut which first appears on the high-current-density points to spread to areas of increasingly lower current density. When the piece has been completely covered with smut, or "old" plate, it is "relieved". This means, in brief, that the highlights are rubbed clean or to a bright finish. In many cases the relieved piece is plated again, this time in a bright-plating solution, to produce still other color effects.

To accentuate such effects still further, the piece may be matte finished either chemically or mechanically before plating, and then only the highlights are cut and glossed. The dull recessed areas will plate with "that aged look", and the highlights will have the necessary sparkle and life to produce the necessary contrast.

Design of such an article is extremely important. A flat-tailored item refuses to become antique. The

easiest way to produce an item which can be antiqued is to make it complicated. Increasing the detail, or ornamentation, is another way. Still another is to furnish it with many small recessed areas.

Gold antiques may be divided into three broad classes:

(a) Rose gold
(b) Green gold smut
(c) Russian antique

These divisions are based essentially on color. Each has its advantages and disadvantages. The true rose gold is used the least, and mainly for such small items as rings, as the cost is extremely high.

Rose Golds.—This term usually applies only to items having yellow-gold highlights and an orange-yellow smutty appearance in the recesses, although occasionally the term has been applied to bright pink- or red-gold plates. Only the antique rose golds will be discussed here.

The most important factors in rose-gold solutions are the gold content, the *p*H, and the amount of cyanide decomposition products. A fresh solution should contain 10–20 dwt/gal (4–8 g/l) of gold to produce a satisfactory finish. A high *p*H, above 13, will improve the finish; however, as the solution is used and builds up in degradation products of cyanide, the *p*H must be progressively lowered to give the same color. A high *p*H under these conditions produces a very "dead" and dirty appearance, and after having been relieved, the highlights have no life or sparkle. Instead of decreasing the *p*H, the usual practice among gold platers is to flash the relieved piece in a new 24K gold-flashing bath to meet the standard for a bright finish. To put still more contrast in the finish, the extreme highlights used to be hand burnished with a special tool. The yellow-gold finish produced with the burnishing tool was bright, hard, extremely tarnish resistant, and contrasted strikingly with the orange recesses. Incidentally, such burnishing makes a good test for adhesion.

Early workers[35–38] generally agreed that the addition of carbonate produced a dark rose. Although the authors of many of the recorded formulas stated that a carbonate content of only 5 oz/gal (37 g/l) or less is necessary, a few advised gradual addition until the proper darkness is obtained. The addition of caustic[37–40] was said to produce a light-rose color in contrast to the dark rose from carbonate solutions. Other additions[36,40,41] were ferrocyanides or ammonium chloride or both. Merigold[40] carried the ammonium chloride effect to the extreme by adding 2 lb/gal (240 g/l) and boiling until the solution became acid to litmus paper. If such treatment did not reduce the *p*H sufficiently, then small amounts of hydrochloric acid were added. The solution was operated at room temperature. Still another variation was that of Proctor[42], who added hyposulfites in quantities large enough to produce a dark plate.

In addition to solution variations, advantage was taken of variations in the surface finish. Depending on the final finish required, the work was sand blasted, matte dipped, or satin finished, and only the highlights were cut and glossed. Such roughened surfaces would then accentuate any tendency of the plating solution to smut.

The writer has found that a high gold content is the most important factor in producing a rose gold on a smooth surface. To intensify the action further either sodium hydroxide or a mixture of ammonia derivatives can be added. As the solution is aged, both by heat and electrolysis, it becomes progressively easier to produce a smut.

The plate as it comes from the bath is an uneven brownish-yellow smut. To make the finish more uniform, the work is generally immersed in a hot cyanide solution, which will tend to bleach the smut, or in some cases, the item is flashed in a 24K solution. The highlights are then relieved by rubbing with bicarbonate or tubbing (barrel burnishing). Thus we see that such a process is just the antithesis of what is wanted in a 24K bath.

In practice, the oldest 24K solutions with their high content of cyanide-decomposition products are used as starting material to get the aged look.

A suggested formula for a new solution and operating condition are:

Gold, as $KAu(CN)_2$	4–6 g/l (10–15 dwt/gal)
Free cyanide, NaCN	3–7 g/l (0.4–1 oz/gal)
Sodium hydroxide	10–20 g/l (1.3–2.6 oz/gal)
Sodium formate	15–22 g/l (2–3 oz/gal)
Urea	7–11 g/l (1–1.5 oz/gal)
Temperature	160–180° F (71–82° C)
Agitation	during the first 3 sec
Time	30–180 sec

If the basis metal is not gold, then there are several methods for reducing the overall cost of a rose-gold finish. One is to plate, at high voltage and room temperature, in the simple copper cyanide bath. After the highlights have been glossed, the smutty recesses require only a small amount of gold to produce the desired effect. Another method of pretreatment is to plate copper by immersion in an acid copper chloride solution at room temperature (1 lb (120 g) of copper carbonate dissolved in 1 gal (1 l) of hydrochloric acid). The otherwise uneven color is made uniform by agitation in a chloride solution. Only a few seconds' strike in a rose-gold solution is necessary, after which the article may be relieved and given a final strike in a 24K gold solution.

Roman gold has not found much favor in the last few decades. Although the term has been used quite loosely, it usually means a dull gold finish. Ordinarily the surface is roughened to a satin or dull matte and then plated in a high-concentration gold solution. If the finish is streaked or uneven, the surface is again scratch brushed or pumiced. Some consider this the real antique finish.

Green-gold smut.—A green-gold-smut finish differs

from the rose-gold finish in that the relieved highlights are a rich, dark green gold, and the recesses are greenish black. It is the simplest antique to produce, and the solution will give satisfactory results over a wide range of concentrations and temperatures. Basically, the smut is produced by adding small amounts of a solution of lead acetate in caustic to a standard green-gold solution until the desired color is obtained. A generalized formula and operating conditions are as follows:

Gold, as $KAu(CN)_2$	1.5–2.5 g/l (4–6 dwt/gal)
Silver, as $KAg(CN)_2$	0.2–0.4 g/l (0.5–1.0 dwt/gal)
Free cyanide, NaCN	15 g/l (2 oz/gal)
Ammonium carbonate	37 g/l (5 oz/gal)
Lead acetate (dissolved in caustic soda)	0.05 g/l (0.007 oz/gal)
Temperature	70–90° F (21–32° C)
Tank voltage	6 volt
Agitation	none
Time	10–60 sec

The lead is added in an amount necessary to produce the desired depth of smut. Larger additions tend to produce smuts which are too soft. This means, in essence, that the smut has no adhesion. As the lead is being plated out, small regular additions are made to maintain the desired smut.

Lead or arsenic salts will produce the desired smut, but if tartar emetic (antimonyl tartrate) is used, the finish, after having been relieved, is very pale, almost white. Sometimes cadmium is used in place of silver to produce the green gold smut.

The smut itself, unlike the rose smut, is quite uniform in appearance and is greenish-black in color. No bleaching or dipping is required.

Highlights are relieved with bicarbonate on a wheel or by tubbing (ball burnishing).

Many modifications have been used, such as a 14K alloy flash over the relieved surface to produce tan-green highlights and darker recesses. Such shades have been called champagne.

The dark-green color may be modified to pale sea-green shades by after-flashing in a standard hot green-gold solution.

A flash of 24K gold will produce a variation of Russian or Roman gold antiques.

Russian antique. Probably the most popular antique finish is Russian antique, which requires no gold in the smut. The base smut solution usually contains silver and one or more other metals, plus a suitable oxidizing agent. The work is agitated during plating in the hot (160–180° F; 71–82° C) smut solution at 6–8 volts for 10–20 seconds. The most desirable color of the smut is a greenish-brown. The work is then relieved in any desired manner (i. e., by hand or on a cotton wheel with moist bicarbonate, or by tubbing), and 24K gold is flashed over the relieved surface. The final finish approaches the natural antique gold produced by time alone. Variations of this type of finish are obtained by varying the initial and final plate to produce colors ranging from pale yellow antiques to dark red-brown antiques.

For those who require much more gold in their Russian antique, there are two additional methods.

The first is, after suitable preparation, to put on a green-gold smut, relieve in a tub, wash, and follow with a rich 24K gold plate. The parts may then be tubbed again if necessary.

The second method is to add lead salts dissolved in sodium hydroxide to a rich (8–10 dwt/gal; 3.2–4 g/l) 24K solution. The articles are then tubbed to relieve the highlights. Such a finish requires only one racking and has found some favor because of this fact. However, after the solution has been in use for some time, the relieved highlights are too dark, and usually a bright 24K plate is required on top of the smut in order that the relieved highlights be satisfactory. Later on, it may be necessary to flash 24K gold over the relieved highlights to bring up the required finish. At this point a new gold-smut solution should be made.

Such factors necessarily make the finish cost much more than the finish by the green-gold-smut method and many times that by the Russian base-smut method.

Most antiques are lacquered to preserve the degree of antique originally applied. With lead, arsenic and basic compounds in the plate, the finish will deteriorate rapidly if not protected from atmospheric moisture.

After Treatment

Drying of highly finished gold-plated work is very important. The older methods of drying in sawdust introduced innumerable chances for scratching of the work. Dust and dirt from the air will rapidly contaminate the sawdust and lead to scratching. More suitable means are hot-blast dryers or ovens with recirculating air. When these means are used it is mandatory that the final rinse be cold deionized water or an alcohol. A hot-water rinse usually will cause water stains on the work; whereas most of the water evaporates in a few seconds, a few droplets remain, which on evaporation leave a residue of all the dirt or impurities that were originally in the hot water.

With alcohol as the final rinse the velocity of the hot air does not have to be very high; but if deionized water is used, the velocity has to be increased enormously so that most of the water is blown off. If this is not done, the drier becomes a hot box, and the water evaporates only slowly as the work heats up. For some work this slow evaporation of water is adequate, but for highly finished work or work with large flat areas, staining will occur.

Parts with concealed pockets, such as cuff links or hollow bracelets, in which hot solutions have displaced the air with water or plating solution, cannot be dried successfully by this procedure. Perchlorethylene de-

(*Continued on page 50*)

New equipment and methods are analyzed and new compositions are evolved in the experimental laboratory to solve production problems and advance the art of polishing and buffing.

Making Finishing Compositions

L. R. EASTMAN

Manager, Composition Department, Frederic B. Stevens, Inc., Detroit, Mich.

THE FINISHING INDUSTRY requires *two* basic services from the manufacturer of polishing and buffing compositions. First, the user is entitled to *uniform* quality and performance of these materials. Second, he is entitled to *new* and *better* products to meet changing requirements and to keep pace with the development of new and improved machinery and methods in his plant.

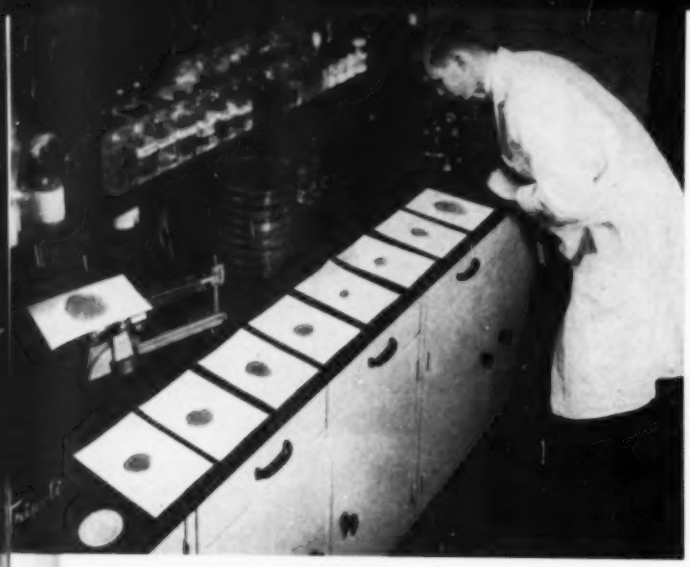
Meeting these two demands calls for the close cooperation of the laboratory, the plant and the service representative. Raw materials must be carefully scrutinized in the laboratory before they are approved for use by the plant. A variety of tests, such as screen analysis and microscopic examination of abrasives, as well as chemical and physical tests of oils, fats and other binder agents, must be made to assure controlled quality. In addition, special tests must be made to find the right materials to solve specific polishing and buffing problems.

The crux of maintaining uniformity of finishing compositions, however, lies in the plant itself. Each type of composition must be mixed in its own separate kettles and tapped into its own molds if contamination is to be prevented. The need for the greatest of care in avoiding contamination is readily apparent when it is considered that there are more than 100 different compositions in common use. The number of raw materials going into these products is even greater.

The new composition plant built by Frederic B. Stevens, Inc., was designed to produce, in quantity, a complete line of finishing compositions that would be uniform in quality, texture and dimensions. It is equipped with precision scales, steam-jacketed mixing kettles, modern materials-handling devices and accurate control instruments, and it is staffed with highly skilled and experienced personnel.

The demand for many varieties of composition arises not only from wide variation of materials to be finished but also from the diverse types of finish required. Thus, it is necessary to provide compositions with suitable characteristics for finishing brass, aluminum, diecastings, the many types of steel, silverware, iron and plated metals, as well as wood, plastics and other materials. Each type of finish—bright, semi-bright or dull—requires a different composition for each material. In addition, different compositions must be used for hand and automatic operations, as well as for different buffs, speeds and pressures. For best results, a composition designed for the particular job must be used.

New and better methods and machines are constantly being developed for polishing and buffing. The composition manufacturer must keep abreast of these developments and have ready the products to go with them. Consequently, Stevens maintains a completely equipped experimental shop where new equipment and processes are analyzed and compositions are evolved that will best meet the problems accompanying faster, more efficient finishing operations.

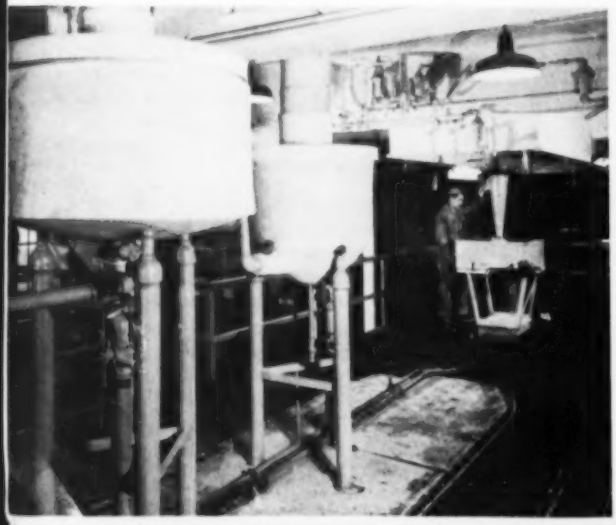


Laboratory facilities for testing materials before mixing is maintained by modern composition manufacturers. Here a chemist is running a test on a sample of Tripoli powder, a widely used natural abrasive, to determine the variation in coarseness. Each pile represents a different grain size. The sa...ple must have a certain percentage size distribution in order that the corresponding lot be accepted for use. Similar tests are made on other types of abrasive. All binder materials are also subjected to laboratory analysis.

The first step (left) in the manufacture of compositions is taken on the second floor of the new, modern Stevens plant. Abrasives are first weighed to meet the formula requirements and then poured into a hopper leading to the proper mixing kettle below.

At the same time the binder, in this case a greasebase material, is run into the mixing kettle (bottom left). The grease is pre-heated to the proper consistency in steam-jacketed kettles. The loading tank, a measuring unit on tracked wheels, is filled from the heating kettles and moved to the loading tubes through which the hot grease is dumped into the proper mixing kettle.

When lime compositions are made, the still liquid composition is allowed to run from the mixing kettle directly into the foil-lined tubes in which they are packaged (bottom right). Mixing kettles and moulds are cleaned thoroughly after each run of a different type of composition to prevent contamination of the product.



Lime compositions are tightly sealed in their containers by means of this special crimping machine, which rolls on metal lids, much the same as the cap on a can of tomatoes. The sealed tubes are then stacked in wooden barrels for storage until shipment.

Bar compositions are loaded (right) in cardboard boxes or barrels for storage and shipping. This picture shows a worker handling one of the larger bars made for automatic polishing equipment. In the background can be seen one of the huge mixing kettles.

Hand-rolled rouges for jewelry, silverware and similar highest-quality products are manufactured in a separate department at the Stevens plant (bottom left). All types and sizes are made and shaped here.

In the final step, the finished compositions, are labeled and set aside for storage in barrels (bottom right). Compositions are aged before shipping, because, like whiskey, they improve with age.

Electroplating of Gold Alloys

(Continued from page 46)

greasers have proved successful in this application. The hot solvent displaces or boils out the water or both, and thus no slow leakage of the entrapped liquids will stain the work. The only other solution, used earlier, was long tumbling in open oblique sawdust tumblers.

One fa or, however, must be watched carefully, or spotting will occur, namely, the buildup of water in the perchlorethylene drier. With sufficient precautions taken to prevent the accumulation of moisture, this method gives excellent results.

The dry work may now be lacquered. An alternate method is to give the work, especially the pinks and other low-karat golds, an anti-tarnish treatment immediately after the final rinse. After drying, the work may be packaged "as is", or lacquered and then packaged.

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Chromic Acid

(Continued from page 41)

meets the requirements of Army-Navy specification AN-O-A-81 (November 28, 1938).

The 250-hour salt-spray specification required by AN-QQ-A-696a can be met in 30 minutes using a 2.5 per cent bath made up with ordinary tap water, except where the water is heavily chlorine treated. The chloride content of the water must not exceed 0.12 g/l (0.016 oz/gal). Chemical methods of analysis are given in specification AN-O-A-81.

Anodizing Operations

After the work has been racked (hung on a carrier rack), washed and rinsed, it is immersed in the anodizing solution, with no current on at time of immersion. The anodizing bath must be maintained at a temperature of 95 ± 5° F. The current is turned on, as low as possible, raised gradually until it reaches 40 volts and held to ± 1 volt until 30 minutes have elapsed. The time usually recommended for raising the voltage to 40 volts is from 6 to 8 minutes. One can raise it much faster, but then when 40 volts have been reached the voltage will continue to rise, and one will need an operator to stand by the controls for the entire 30 minutes required to form the anodic film. If the voltage is raised as recommended, it will remain constant, and the operator can get more work ready for the next load.

When the capacity of the low-voltage equipment is being calculated it is good practice to use as a basis 8–10 amperes per each square foot (0.86–1.1 amp/dm²) of work that the tank will hold. After the 40 volts have been reached, the steady operating current density varies between 1 and 3 asf (0.11–0.32 amp/dm²).

In the early days, the chromic acid solution was simply used until it ceased to operate. Today it is maintained at a *p*H value between 0.85 and 1.0 and at a specific gravity of from 1.075 to 1.091, and the *p*H and composition are controlled by drawing off a part of the solution and adding water and fresh chromic acid. Under these conditions, a film thickness of approximately 0.00004 inch will be produced at a current density of about 2 asf (0.22 amp/dm²).

To facilitate later handling, the anodic treatment is followed by a plain water rinse at a temperature of 160–170° F.

Several papers have provided information that has proved useful in our work. They are given in the short bibliography.

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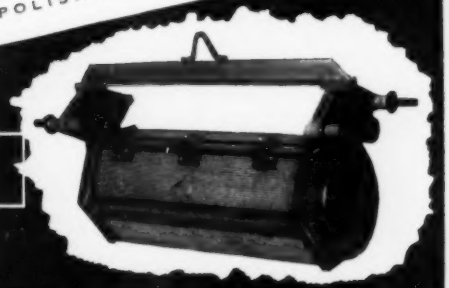

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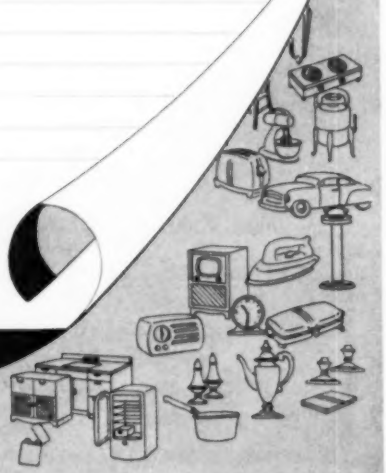

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*AUTHORS

Cleaning and Preparation of Metals for Electroplating

IV. DEGREASING EVALUATION TESTS: SEQUENTIAL TESTING

(CONTINUED FROM THE DECEMBER, 1951 ISSUE)

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5. APPENDICES

(a) *Variance Analysis*

The statistical criteria used in this project have been briefly introduced in a previous paper[10d]. An additional concept is presented in this paper, the "variance test". Just as the "*t*" test has been used to indicate whether or not a statistically significant difference exists between the *means* ($\bar{X}$) of two sets of data, so the variance test may be used to indicate whether or not a statistically significant difference exists between the *standard deviations* (σ) of two sets of data. In analogous fashion to the "*t*" test, the value of the variance ratio (F) is compared to the table value for any chosen level of significance (F_{table}); if F exceeds F_{table}, a difference in reproducibility is established; if not, a difference in reproducibility is not established. The value of F is calculated as follows:

$$F = \frac{\sigma_A^2}{\sigma_B^2}, \text{ where } \sigma_A > \sigma_B$$

(b) *Statistical Analysis of Results*

Table VIII presents a comparison of the soiling and cleaning results obtained with dyed soils as compared with those obtained with the unmodified oils used previously. Inspection of the table will show that the "*t*" test indicates that in no cases are there any statistically meaningful differences established between the values of the mean ($\bar{X}$). Inspection of variance-ratio values (F) shows that in two cases there are significant differences. The first of these concerns the amount of soiling with mineral oil. Although the value of the means do not differ statistically, the panels soiled with dyed mineral oil show poorer reproducibility than those soiled with undyed oil. The physical basis for this difference appears to be due to the fact that the dye does not form a complete solution in the oil, but, to a slight extent, precipitates out. This fact adversely affects reproducibility. The second case of failure of the variance (F) test concerns the atomizer-test results with mineral oil. There seems to be no readily apparent physical basis for this difference.

The results obtained with the sequential tests, which were discussed qualitatively in 3(c) Discussion, will now be discussed quantitatively (see Table IX for statistical analysis of the results presented in Table V and Fig. 3).

Series 1.—In two of the three cases, no significant difference is found between the spray-pattern and copper-dip tests, as the values for t are smaller, 0.97 and

TABLE VIII. COMPARISON OF UNDYED AND DYED SOILS

Soil	$\bar{X} \pm L$	σ	n	t	$t_{0.05}$	Difference in $\bar{X}$ established at 0.05 level	F	$F_{0.05}$	Difference in σ established at 0.05 level
				Gravimetric Soiling Test, g					
Undyed Mineral Oil	0.0966 ± 0.0012	0.0014	8						
Dyed Mineral Oil	0.0972 ± 0.0073	0.0063	5	0.26	2.20	No	20.2	4.12	Yes
Undyed Lard Oil	0.1250 ± 0.0028	0.0034	8						
Dyed Lard Oil	0.1285 ± 0.0036	0.0029	5	1.92	2.20	No	1.38	6.10	No
				Atomizer Test, C.I.					
Cleaned at 70° C for 3 min									
Undyed Lard Oil	9.0 ± 5.1	8.0	12						
Dyed Lard Oil	9.5 ± 3.6	5.3	11	0.18	2.08	No	2.29	2.95	No
Cleaned at 70° C for 10 min									
Undyed Lard Oil	17.7 ± 3.8	6.0	12						
Dyed Lard Oil	23.1 ± 6.2	9.8	12	1.61	2.07	No	2.65	2.83	No
Cleaned at 40° C for 3 min									
Undyed Mineral Oil	37.2 ± 8.9	14.0	12						
Dyed Mineral Oil	41.0 ± 4.7	7.4	12	0.83	2.07	No	3.58	2.83	Yes

0.38, than the value for $t_{0.05}$, 2.45. In the case of lard oil at 70° C and 10 minutes, t is larger than $t_{0.05}$, so that a real difference is established. The value of $\bar{X}_1-\bar{X}_2$ is 3.4 and L is only about 2/3 of this value.

Series II.—In two of three cases, no significant difference is found between the spray-pattern and KFC tests. In the case of mineral oil, a real difference is established, though it is hardly a very important one, $\bar{X}_1-\bar{X}_2$ being but 2.5 and L being 2.0.

Series III.—The spray-pattern test differs much more widely from the fluorescent-dye test than from either the copper-dip or KFC tests. Yet, primarily because of the larger σ's in the series, a real difference is established in only one out of three cases. It appears to be a random chance that the value of σ for the spray-pattern test, in the two cases where no difference is established, is much larger than in either Series I or II.

Series IV.—The atomizer test has been omitted from the tables because it differs so obviously from the other tests that a statistical analysis cannot shed any new information on the subject. The fluorescent-dye and KFC tests show significant differences in all three cases as t is in all cases greater than $t_{0.05}$.

Series V.—The atomizer test is omitted for the reason already stated.

Series VI.—The atomizer test is omitted for the reason already stated. The fluorescent-dye and copper-dip tests are found to show significant differences in all three cases, as seen by the large value of t and the correspondingly small values of L.

Averages.—The average values for each evaluation test, taken from all the series from I to VI are also tabulated and analyzed. As n here ranges from 7 to 12, the broadest conclusions may be drawn from an analysis of this portion of the table. The relationship of each test to all the others will now be taken up in detail.

Atomizer: The atomizer test differs very significantly from all the other tests. The value of t is very large, ranging from 14.2 to 35.1. Furthermore, $\bar{X}_1-\bar{X}_2$ is very large, ranging from 42.2 to 79.2, with values of L ranging only from 4.5 to 7.5.

Fluorescent-dye: The fluorescent-dye test differs significantly from all the other tests. As compared with the atomizer test, however, the difference is not as well established: t ranges from 5.1 to 20.2, the difference in the means is much less (9.2 to 62.1), and L is correspondingly more significant in value (2.3 to 8.0).

Spray-pattern: In all cases, the spray-pattern test differs significantly from the atomizer and fluorescent-dye tests. In two cases, it differs significantly from the copper-dip test, but the remaining case is on the borderline. However, the $\bar{X}_1-\bar{X}_2$ value is comparatively minor (2.7–4.4), and L is 63–64 per cent of the value of $\bar{X}_1-\bar{X}_2$ in the two cases where a difference is established. This test does not differ significantly from the KFC test in two cases out of three. In the remaining case, t is only 2.7, and the difference in the means is but 2.8, with L having a value of 2.2.

KFC: The KFC test differs significantly from the atomizer and fluorescent-dye tests in all cases, and from the spray-pattern test in one case (see above). In two cases out of three, there is, to all intents and purposes, no difference between the KFC and copper-dip tests. In one case, t is 2.75, but the value of $\bar{X}_1-\bar{X}_2$ is very small (1.7 ± 1.3), and the origin of this apparent real difference is due to the very small value of σ for both tests.

Copper-dip: The copper-dip test differs significantly in all cases from the atomizer and fluorescent-dye tests. It differs from the spray-pattern test in two cases out of

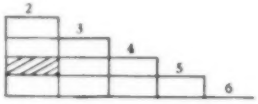
TABLE IX. CORRELATION OF DEGREASING EVALUATION TESTS

Seq. Series	Test	$\bar{X} \pm L$ σ n	t^*	$t_{0.05}$*	$(\bar{X}_1 - \bar{X}_2) \pm L$*
		Lard Oil—70° C—3 min'			
I	2. Spray-pat.	84.1 ± 6.2 3.9 4			
	5. Copper-dip	87.6 ± 9.7 6.1 4	0.97	2.45	3.5 ± 8.8
II	2. Spray-pat.	83.2 ± 21.3 8.6 3			
	6. KFC	90.2 ± 14.6 5.9 3	1.16	2.78	7.0 ± 16.8
III	2. Spray-pat.	85.5 ± 13.2 5.3 3			
	4. Fluor.-dye	58.1 ± 27.3 11.0 3	3.9	2.78	27.4 ± 19.5
IV	4. Fluor.-dye	46.6 ± 5.1 3.2 4			
	6. KFC	82.2 ± 13.4 8.4 4	7.9	2.45	35.6 ± 11.0
VI	4. Fluor.-dye	52.1 ± 4.2 1.7 3			
	5. Copper-dip	89.7 ± 20.4 8.2 3	7.8	2.78	37.6 ± 13.4
Av.	2. Spray-pat.	84.3 ± 3.8 5.3 10	2	2	2
	3. Atomizer	9.5 ± 3.6 5.3 11	32.4 3	2.09 3	74.8 ± 4.8 3
	4. Fluor.-dye	51.7 ± 5.4 7.5 10	11.2 15.1 4	2.10 2.09 4	32.6 ± 6.1 42.2 ± 5.9 4
	5. Copper-dip	88.7 ± 3.6 5.3 11	1.90 35.1 13.2 5	2.09 2.09 2.09 5	4.4 ± 4.8 79.2 ± 4.7 37.0 ± 5.9 5
	6. KFC	85.6 ± 7.4 8.0 7	0.41 24.6 9.0 0.99 6	2.13 2.12 2.13 2.12 6	1.3 ± 6.8 76.1 ± 6.6 33.9 ± 8.0 3.1 ± 6.6 6
		Lard Oil—70° C—10 min			
I	2. Spray-pat.	95.4 ± 2.7 1.7 4			
	5. Copper-dip	98.8 ± 0.5 0.3 4	3.9	2.45	3.4 ± 2.1
II	2. Spray-pat.	94.6 ± 5.4 3.4 4			
	6. KFC	97.2 ± 1.3 0.8 4	1.47	2.45	2.6 ± 4.3
III	2. Spray-pat.	93.3 ± 10.5 6.6 4			
	4. Fluor.-dye	85.2 ± 4.9 3.1 4	2.22	2.45	8.1 ± 8.9
IV	4. Fluor.-dye	84.1 ± 5.2 3.3 4			
	6. KFC	96.1 ± 4.5 2.8 4	5.55	2.45	12.0 ± 5.3
VI	4. Fluor.-dye	86.4 ± 9.7 6.1 4			
	5. Copper-dip	97.7 ± 1.7 1.1 4	3.64	2.45	11.3 ± 7.7
Av.	2. Spray-pat.	94.4 ± 2.6 4.1 12	2	2	2
	3. Atomizer	23.1 ± 6.2 9.8 12	23.2 3	2.07 3	71.3 ± 6.3 3
	4. Fluor.-dye	85.2 ± 2.6 4.1 12	5.5 20.2 4	2.07 2.07 4	9.2 ± 3.5 62.1 ± 6.4 4
	5. Copper-dip	98.3 ± 0.5 0.8 12	3.2 26.2 10.7 5	2.07 2.07 2.07 5	3.9 ± 2.5 75.2 ± 5.8 13.1 ± 2.3 5
	6. KFC	96.6 ± 1.7 2.0 8	1.42 20.6 7.4 2.75 6	2.10 2.10 2.10 2.10 6	2.2 ± 3.3 73.5 ± 7.5 11.4 ± 3.2 1.7 ± 1.3 6
		Mineral Oil—40° C—3 min			
I	2. Spray-pat.	98.3 ± 0.5 0.3 4			
	5. Copper-dip	98.5 ± 1.6 1.0 4	0.38	2.45	0.2 ± 1.3
II	2. Spray-pat.	95.0 ± 1.4 0.9 4			
	6. KFC	97.5 ± 2.2 1.4 4	3.0	2.45	2.5 ± 2.9

TABLE IX. CORRELATION OF DEGREASING EVALUATION TESTS (Continued)

Seq. Series	Test	$\bar{X} \pm L$	σ	n	t^*	$t_{0.05}{}^*$	$(\bar{X}_1 - \bar{X}_2) \pm L^*$
III	2. Spray-pat.	95.4 ± 4.8	3.0	4			
	4. Fluor.-dye	87.1 ± 9.9	6.2	4	1.82	2.45	6.3 ± 8.5
IV	4. Fluor.-dye	86.9 ± 14.0	8.8	4			
	6. KFC	99.2 ± 1.3	0.8	4	2.76	2.45	12.3 ± 10.9
VI	4. Fluor.-dye	78.0 ± 4.5	2.8	4			
	5. Copper-dip	98.3 ± 0.8	0.5	4	14.2	2.45	20.3 ± 3.5
Av.	2. Spray-pat.	95.6 ± 1.7	2.7	12	2	2	2
	3. Atomizer	41.0 ± 4.7	7.4	12	23.9 — 3	2.07 — 3	54.6 ± 4.7 — 3
	4. Fluor.-dye	83.9 ± 4.7	7.4	12	5.1 — 14.2 — 4	2.07 — 2.07 — 4	11.7 ± 4.7 — 42.9 ± 6.2 — 4
	5. Copper-dip	98.3 ± 0.6	0.9	12	3.3 — 26.5 — 6.7 — 5	2.07 — 2.07 — 2.07 — 5	2.7 ± 1.7 — 57.3 ± 4.5 — 14.4 ± 4.5 — 5
	6. KFC	98.4 ± 1.2	1.4	8	2.7 — 21.2 — 5.4 — 0.19 — 6	2.10 — 2.10 — 2.10 — 2.10 — 6	2.8 ± 2.2 — 57.4 ± 5.6 — 14.5 ± 5.7 — 0.1 ± 1.1 — 6

NOTE: In presenting t and L data when more than two tests are involved, a triangular type of tabulation is used. The numbers at the top of each column and at the right of each row refer to the evaluation tests involved. Thus, if seeking the t and L value for the difference between tests 2 and 5, the indicated box is used:



three, with the remaining case on the borderline (see above). It differs from the KFC test in one case out of three (see above).

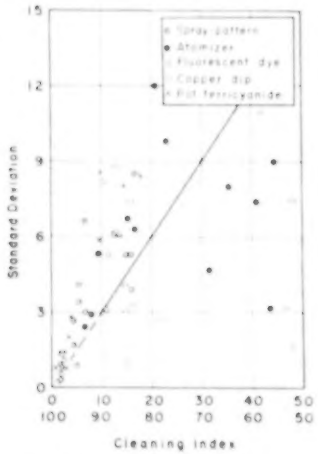


Fig. 1. Reproducibility of degreasing-evaluation tests, with each individual evaluation test shown separately

(c) *Reproducibility of the Sequential Tests*

Because many of the degreasing-evaluation tests interfere with one another, it was not possible to run all tests on one panel; instead it was necessary to utilize six sequences. In averaging the values of these sequences in order to compare all the tests with one another, it is implicitly assumed that the C.I. values for any given test at a particular cleaning condition will be comparable in all the sequences involved. Table X gives values for the reproducibility of the results obtained for any test at a particular cleaning condition in all the pertinent sequences. Thirty-nine values of t and of F appear. Of these, five t values and seven F values exceed the table values (0.05 level of significance). These failures may be broken down as follows:

Test	t	F
Spray-pattern	2	3
Atomizer	1	0
Copper-dip	0	1
Fluorescent-dye	2	2
KFC	0	1

Thus, the spray-pattern and fluorescent-dye tests account for 75 per cent of the test failures; in other words, under the same cleaning conditions, the results obtained in the different series are least reproducible in the case of these two tests.

With regard to the series proper, the failures of the t and F tests may be tabulated as follows:

Sequence	*Failures*	*Sequence*	*Failures*
I	3	IV	4
II	3	V	0
III	6	VI	6

Of these sequences, only V does not involve either the spray-pattern or fluorescent-dye tests. With this in mind, it is readily evident that no inherent differences have been detected between the various sequential series. Hence, the various tests involved in each sequential series do not notably interfere with each other.

The irregularities observed with the spray-pattern test seem to be associated with the fact that this test is more sensitive near the top of the panel than near the bottom. With the fluorescent-dye test, irregularities are probably associated with spreading of oil during photographing.

It was previously shown in connection with the atomizer test[10a] that the value of σ was, in general, a function of the C.I.

TABLE X. THE SEQUENTIAL SERIES—REPRODUCIBILITY OF C.I. RESULTS

Test	Seq. Series	$\bar{X}$	σ	n	t^*	$t_{0.05}$*	F^*	$F_{0.05}$*
Lard Oil—70° C—3 min								
2. Spray-pattern	I	84.1	3.9	4	I	I	I	I
	II	83.2	8.6	3	0.19 II	2.57 II	4.86 II	9.55 II
	III	85.5	5.3	3	0.41 | 0.39 III	2.57 | 2.78 III	1.84 | 2.64 III	9.55 | 19.00 III
	Av.	84.3	5.3	10				
3. Atomizer	IV	6.6	2.4	4	IV	IV	IV	IV
	V	7.9	2.9	4	0.69 V	2.45 V	1.46 V	9.28 V
	VI	15.3	6.7	3	2.42 | 2.02 VI	2.57 | 2.57 VI	7.80 | 5.32 VI	9.55 | 9.55 VI
	Av.	9.5	5.3	11				
4. Fluorescent-dye	III	58.1	11.0	3	III	III	III	III
	IV	46.6	3.2	4	2.04 IV	2.57 IV	10.9 IV	9.55 IV
	VI	52.1	1.7	3	0.93 | 2.66 VI	2.78 | 2.57 VI	42.0 | 3.55 VI	19.00 | 19.16 VI
	Av.	51.7	7.5	10				
5. Copper-dip	I	87.6	6.1	4	I	I	I	I
	V	89.2	3.1	4	0.47 V	2.45 V	3.87 V	9.28 V
	VI	89.7	8.2	3	0.39 | 0.12 VI	2.57 | 2.57 VI	1.81 | 7.00 VI	9.55 | 9.55 VI
	Av.	88.7	5.3	11				
6. KFC	II	90.2	5.9	3	II	II	II	II
	IV	82.2	8.4	4	1.40 IV	2.57 IV	2.03 IV	19.16 IV
	Av.	85.6	8.0	7				
Lard Oil—70° C—10 min								
2. Spray-pattern	I	95.4	1.7	4	I	I	I	I
	II	94.6	3.4	4	0.42 II	2.45 II	4.00 II	9.28 II
	III	93.3	6.6	4	0.62 | 0.35 III	2.45 | 2.45 III	15.0 | 3.77 III	9.28 | 9.28 III
	Av.	94.4	4.1	12				
3. Atomizer	IV	16.9	6.3	4	IV	IV	IV	IV
	V	21.0	12.0	4	0.87 V	2.45 V	3.64 V	9.28 V
	VI	31.5	4.7	4	3.68 | 1.63 VI	2.45 | 2.45 VI	1.80 | 6.51 VI	9.28 | 9.28 VI
	Av.	23.1	9.8	12				
4. Fluorescent-dye	III	85.2	3.1	4	III	III	III	III
	IV	84.1	3.3	4	0.48 IV	2.45 IV	1.14 IV	9.28 IV
	VI	86.4	6.1	4	0.36 | 0.67 VI	2.45 | 2.45 VI	3.86 | 3.42 VI	9.28 | 9.28 VI
	Av.	85.2	4.1	12				
5. Copper-dip	I	98.8	0.3	4	I	I	I	I
	V	98.5	0.6	4	0.88 V	2.45 V	4.00 V	9.28 V
	VI	97.7	1.1	4	1.92 | 1.27 VI	2.45 | 2.45 VI	13.4 | 3.36 VI	9.28 | 9.28 VI
	Av.	98.3	0.8	12				
6. KFC	II	97.2	0.8	4	II	II	II	II
	IV	96.1	2.8	4	0.74 IV	2.45 IV	12.2 IV	9.28 IV
	Av.	96.6	2.0	8				

TABLE X. THE SEQUENTIAL SERIES—REPRODUCIBILITY OF C.I. RESULTS (Continued)

Test	Seq. Series	$\bar{X}$	σ	n	t°	$t_{0.05}{}^\circ$	F°	$F_{0.05}{}^\circ$
					Mineral Oil—40° C—3 min			
2. Spray-pattern	I	98.3	0.3	4	I	I	I	I
	II	95.0	0.9	4	6.96 II	2.45 II	9.00 II	9.28 II
	III	93.4	3.0	4	3.30 | 1.03 III	2.45 | 2.45 III	100.0 | 11.2 III	9.28 | 9.28 III
	Av.	95.6	2.7	12				
3. Atomizer	IV	43.6	3.2	4	IV	IV	IV	IV
	V	44.0	9.1	4	0.33 V	2.45 V	8.10 V	9.28 V
	VI	35.4	8.0	4	1.90 | 1.61 VI	2.45 | 2.45 VI	6.22 | 1.30 VI	9.28 | 9.28 VI
	Av.	41.0	7.4	12				
4. Fluorescent-dye	III	87.1	6.2	4	III	III	III	III
	IV	86.9	8.8	4	0.04 IV	2.45 IV	2.02 IV	9.28 IV
	VI	78.0	2.8	4	2.68 | 1.93 VI	2.45 | 2.45 VI	4.90 | 9.88 VI	9.28 | 9.28 VI
	Av.	83.9	7.4	12				
5. Copper-dip	I	98.5	1.0	4	I	I	I	I
	V	98.0	1.3	4	0.61 V	2.45 V	1.69 V	9.28 V
	VI	98.3	0.5	4	0.35 | 0.43 VI	2.45 | 2.45 VI	4.00 | 6.79 VI	9.28 | 9.28 VI
	Av.	98.3	0.9	12				
6. KFC	II	97.5	1.4	4	II	II	II	II
	IV	99.2	0.8	4	2.10 IV	2.45 IV	3.06 IV	9.28 IV
	Av.	98.4	1.4	8				

See note at bottom of Table IX.

value. The σ values of Table X have been plotted on the same basis in Fig. 4, with the values for each evaluation test being marked separately. From the curve, it is easy to observe that the most obvious relationship is that σ increases as C.I. increases from 0–50, and decreases as C.I. increases from 50–100. This being the case, the reproducibility of the various tests cannot be compared directly, because for any cleaning condition the value of C.I. (and thus that of σ) differs between the various tests. In order to obtain a more direct comparison of the reproducibility of the different tests, it is necessary to convert the C.I. values to their logarithms (or the logarithms of the 100 − C.I. values in the range 50–100) and to recalculate the σ's. (If σ is a linear function of the variable, taking logarithms renders σ constant.) The results of this operation are shown in Fig. 5a. Using methods of regression analysis (see any text on statistical analysis for details), the equation of the curve relating $\sigma_{\ln}$ with ln C.I. was found to be:

$$\sigma_{\ln} = 0.602 - 0.0876 \ln \text{C.I.}$$
$$L_{5\%\text{level}} = \pm 0.409$$

The negative slope (-0.0876; $L = \pm 0.0560$) indicates that the linear relation of Fig. 4 does not hold strictly. In the region C.I. = 0–20 and 80–100, σ is a linear function of C.I. As C.I. approaches 50, the value of σ tends to taper off to a constant value. It will be observed in Fig. 5a that the points are quite scattered. The correlation coefficient for the curve, however, is 0.446 which, for $n = 42$, corresponds to less than one chance in 300 that the relation is a random one. In Fig. 5b the curve of $\sigma_{\ln}$ vs. ln C.I. has been plotted separately for each test. The points on the curves correspond to the mean values. Bearing in mind that $\sigma_{\ln}$ tapers off as C.I. approaches 50, it is seen that the reproducibility of all the tests is on a par. In the curves of Fig. 5b, $L_{5\%\text{ level}} = \pm 0.33$ to ± 0.58.

Thus, the conclusion is that whereas some of the tests are more sensitive than others, their reproducibilities do not differ significantly under comparable conditions.

(d) *Sensitivity Data*

Table VII showed some salient results obtained for sensitivity. Table XI contains the information used to calculate the values of sensitivity listed in Table VII. The minimum size of particle visible in each test was obtained by careful comparison of pantograph tracings and fluorescent-dye photographs to determine what was the smallest class of oil globule that was customarily detected by the particular test. Occasionally, still smaller globules might be detected, but such occasional values were disregarded in determining the value for the minimum size of particle. For the copper-dip and KFC tests, the value was 0.0005 in² (0.3 mm²); for the wettability tests, 0.001 in² (0.6 mm²). In the fluorescent-dye test, with lard oil, much smaller globules of oil were

TABLE XI. CALCULATION OF EQUIVALENT SENSITIVITY

Test	Minimum Size Particle	
	in²	cm²
2. Spray-pattern	0.001	0.00645
3. Atomizer	0.001	0.00645
4. Fluorescent-dye—Lard	0.00025	0.00161
Mineral	0.002	0.0129
5. Copper-dip	0.0005	0.00323
6. KFC	0.0005	0.00323

Oil	Temp °C	Time min	Amount Residual Oil	
			g/panel	g/cm²
Lard	70	3	0.0676	805×10^{-6}
Lard	70	10	0.0076	90×10^{-6}
Mineral	40	3	0.0032	38×10^{-6}

Test	Panel Area, cm²
Gravimetric	83.9
All other	38.7

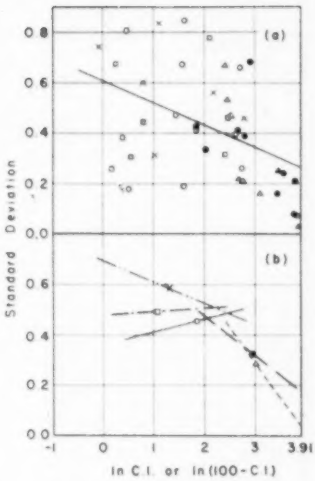


Fig. 5. Reproducibility of degreasing-evaluation tests. (a) Each individual evaluation test shown separately; (b) each type of test shown by separate curve

TABLE XI. CALCULATION OF EQUIVALENT SENSITIVITY (Continued)

Test	100 − C.I.	Apparent Soiled Area cm²	Residual Oil g/cm²	Apparent Oil Conc. g/cm²	Equivalent Sensitivity g/cm²
Lard Oil—70° C—3 min					
2. Spray-pattern	15.7	6.09	805×10^{-6}	0.0051	5.5×10^{-6}
3. Atomizer	90.5	35.0	805×10^{-6}	0.00089	1.6×10^{-7}
4. Fluor.-dye	48.3	18.7	805×10^{-6}	0.00167	1.4×10^{-7}
5. Copper-dip	11.3	4.38	805×10^{-6}	0.0071	5.3×10^{-6}
6. KFC	14.4	5.58	805×10^{-6}	0.0056	3.2×10^{-6}
Lard Oil—70° C—10 min					
2. Spray-pattern	5.6	2.16	90×10^{-6}	0.00162	4.8×10^{-6}
3. Atomizer	76.9	29.7	90×10^{-6}	0.00012	0.3×10^{-7}
4. Fluor.-dye	14.3	5.54	90×10^{-6}	0.00061	1.7×10^{-7}
5. Copper-dip	1.7	0.66	90×10^{-6}	0.0053	26.0×10^{-6}
6. KFC	3.4	1.32	90×10^{-6}	0.0027	6.5×10^{-6}
Mineral Oil—40° C—3 min					
2. Spray-pattern	4.4	1.70	38×10^{-6}	0.00087	3.3×10^{-6}
3. Atomizer	59.0	22.8	38×10^{-6}	0.000065	0.2×10^{-7}
4. Fluor.-dye	16.1	6.24	38×10^{-6}	0.00024	4.9×10^{-7}
5. Copper-dip	1.7	0.66	38×10^{-6}	0.0022	11.0×10^{-6}
6. KFC	1.6	0.62	38×10^{-6}	0.0024	12.4×10^{-6}

readily detected (0.00025 in²; 0.16 mm²) than in the other tests. With mineral oil, however, spreading caused such small globules to spread out so thinly as not to photograph. Larger globules spread to give blurred images, so that the smallest class of images visible is on the order of 0.002 in² (1.3 mm²).

The column of figures labelled "Apparent Oil Concentration" is of interest. It will be seen that in every case the values for the atomizer test are much lower than for all other tests. This is due to the fact, previously discussed, that in this test small areas of oil cause large areas of water drops to form. As this test approaches a "stop-or-go" type of test, it would be expected that, as the amount

TABLE XII. LABORATORY DATA

Sequential Series	Run No.	Sample	2 Spray-pattern	3 Atomizer	4 Fluor.-Dye	5 Copper-dip	6 KFC	1 Water-break sec
			Lard Oil—70° C—3 min					
I	1	A	81.5			78.8		0
	2	A	88.9			88.7		0
	3	A	85.6			92.9		0
	4	A	80.5			89.9		0
II	5	A	77.3				93.0	0
	6	A	79.3				83.4	0
	7	A	93.1				94.1	0
	8	A	*				*	*
III	5	B	80.4		63.4			0
	6	B	85.2		45.5			0
	7	B	91.1		65.4			0
	8	B	*		*			*
IV	1	B		3.5	49.4		70.6	0
	2	B		7.9	47.1		85.2	0
	3	B		9.1	48.0		82.8	0
	4	B		6.0	41.8		90.3	0
V	1	C		6.3		88.5		0
	2	C		4.8		85.9		0
	3	C		11.3		93.3		0
	4	C		9.3		88.9		0
VI	5	C		21.6	51.0	93.1		0
	6	C		16.1	54.0	89.4		0
	7	C		8.2	51.2	95.7		0
	8	C		*	*	*		0

7. Gravimetric (mg): 72.6, 72.7, 66.5, 61.5, 64.3, 68.1; Average 67.6

			Lard Oil—70° C—10 min					
I	1	A	97.9			98.5		0
	2	A	94.7			99.2		0
	3	A	94.8			98.8		0
	4	A	94.3			98.8		0
II	5	A	90.2				97.2	0
	6	A	97.9				97.0	0
	7	A	96.5				96.2	0
	8	A	93.7				98.2	0
III	5	B	83.5		85.6			0
	6	B	97.6		83.7			0
	7	B	95.1		89.2			0
	8	B	96.8		82.1			0
IV	1	B		20.8	80.4		96.5	0
	2	B		23.6	82.1		99.0	0
	3	B		12.9	86.4		96.8	0
	4	B		10.4	87.3		92.2	0

of residual oil reaches small values, the discrepancy between the value of "apparent oil concentration" for the atomizer and the other tests would become greater. This is indeed seen to be the case. Where only about one-half of the oil is removed, the ratio of values obtained with the fluorescent-dye test and the atomizer test is about 2:1. Where over 90 per cent of the oil is removed, this ratio is 4:1 or 5:1.

In the fluorescent-dye test, the effect o spreading of mineral oil can also be seen, in that the value of "apparent oil concentration" is unduly low in comparison with the copper-dip and the KFC values; the latter two tests are known, from the results obtained in Table X, not to be affected by spreading.

In the spray-pattern test, the values of "apparent oil concentration" serve to illustrate the effect of failure of the test not only where oil globules are present but in a band surrounding such globules as well. Where half of the oil yet remains, this factor is not important, and the values obtained for the spray-pattern, copper-dip, and KFC tests are about equal. Where over 90 per cent of the oil has been removed, this factor of failure of the wetting test in a band around oil globules becomes more important. Here, it is found that the value of the "apparent oil concentration" for the spray-pattern test is 2–3 times smaller than the value for the copper-dip and KFC tests.

(e) *Laboratory Data*

All laboratory data are presented in Table XII.

(f) *Nomenclature*

C.I. = cleaning index = per cent of panel area which is "clean"
Inf. = infinity
KFC = potassium ferricyanide
L = confidence limit at the 0.05 level of significance
n = number of samples
t = test of significance of the value of the difference in the value of the means of two sets of samples
$t_{0.05}$ = the value of t for the 0.05 level of significance
$\bar{X}$ = average value of a set of observations
σ = standard deviation

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TABLE XII. LABORATORY DATA—*(Continued)*

Sequential Series	Run No.	Sample	2 Spray-pattern	3 Atomizer	4 Fluor.-Dye	5 Copper-dip	6 KFC	1 Water-break sec
			Lard Oil—70° C—10 min					
V	1	C		15.5		98.6		0
	2	C		26.4		99.1		0
	3	C		34.7		97.7		0
	4	C		7.4		98.5		0
VI	5	C		25.1	91.5	98.5		0
	6	C		31.3	83.5	96.1		0
	7	C		33.5	91.5	98.4		0
	8	C		36.1	79.2	97.6		0
			7. Gravimetric (mg): 10.6; 7.9; 7.3; 5.4; 6.2; 8.1; Average 7.6					
			Mineral Oil—40° C—3 min					
I	1	A	98.2			97.3		0 + α
	2	A	97.9			99.1		0 + α
	3	A	98.5			98.2		0 + α
	4	A	98.6			99.4		0 + α
II	5	A	94.1				95.7	0 + α
	6	A	95.4				97.6	0 + α
	7	A	96.1				97.8	0 + α
	8	A	94.4				99.0	0 + α
III	5	B	94.0		84.8			0 + α
	6	B	89.0		79.6			0 + α
	7	B	95.9		94.0			0 + α
	8	B	94.5		89.8			0 + α
IV	1	B		39.9	90.9		100.0	0 + α
	2	B		47.2	74.6		98.3	0 + α
	3	B		42.3	87.2		98.9	0 + α
	4	B		44.8	94.9		99.6	0 + α
V	1	C		34.1		97.0		0 + α
	2	C		40.5		96.7		0 + α
	3	C		55.5		99.3		0 + α
	4	C		45.9		99.1		0 + α
VI	5	C		45.0	75.4	97.8		0 + α
	6	C		34.6	82.6	98.7		0 + α
	7	C		25.4	77.8	97.8		0 + α
	8	C		36.5	76.0	98.7		0 + α
			7. Gravimetric (mg): 3.8; 2.3; 4.1; 2.1; 3.8; 3.2; Average 3.2					

This is contribution No. 24 from the Chemical Engineering Department, Engineering Center, Columbia University, New York, N. Y. This paper is based on laboratory work done between September, 1950 and January, 1951.

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REPORT OF ADVISORY COMMITTEE ON ACCELERATED CORROSION TESTS

To the Research Directing Sub-Committee of the A.E.S. Research Committee

I. MEMBERSHIP

The following are the names of the members of this Committee: W. Blum, K. G. Compton, Carl Durbin, C. E. Heussner, F. L. LaQue, Chairman; J. L. McCloud, C. F. Nixon, W. M. Phillips, W. L. Pinner, H. A. Pray, W. M. Tucker, W. A. Wesley, with B. C. Case and G. M. Cole, ex officio.

II. TERMS OF REFERENCE

This Advisory Committee was organized by B. C. Case in February, 1950, to aid the Research Directing Committee in reaching a decision as how best to proceed to study the problem of developing satisfactory "Accelerated Tests for the Performance of Plated Coatings". This Advisory Committee was to examine the problem and submit its recommendations to the Research Directing Committee. The present report embodies these recommendations.

III. RECOMMENDATIONS

1. The salt spray (fog) test as it is now employed is not satisfactory and should be modified or replaced.

2. It will be necessary to make a distinction between tests used for inspection and those devised to estimate performance in service—a single test is not likely to be suitable for both purposes nor for use with a variety of coating and basis-metal combinations.

3. An inspection test should have a rational relationship to service requirements and performance.

4. The widespread availability of equipment for carrying out the salt-spray (fog) test should be kept in mind, and an effort should be made to develop an improved test that would permit the use of this equipment without restricting any new test to modifications of the current salt-spray (fog) test. Much could be done by a clear delineation of the most advisable interpretation of results. The simultaneous testing of both panels and parts would be desirable.

5. With due regard to the limitations indicated by Items 1 to 4 inclusive, it is recommended that the A. E. S. sponsor a project to study accelerated corrosion tests. The desired accelerated test is one which will:

a. Disclose existing discontinuities in electrodeposited coatings.

b. Create new discontinuities in a systematic way at a rate which can be duplicated from test to test and which can be related to a widely representative practical environment.

The development of the project should proceed along the following lines:

A. Start by studying the performance in test and in service of decorative plated coatings over steel in terms of their behavior under the conditions represented by use on an automobile in Detroit during winter months. The minimum acceptable level of performance would be satisfactory service for one winter.

B. As a guide to the selection of a possibly useful testing medium, a task group should be formed to secure an accurate description of the nature of the environment which causes deterioration of decorative plating in Detroit during a typical winter. This would include attention to the abrasive effects of the grit in the air, as well as to chemical factors.

C. If results of A and B should lead to a test showing satisfactory correlation between performance in test and performance in service, additional research should be directed towards modifications of the test to adapt it to other combinations of basis metals and coating metals and possibly to other environments and other uses. It is recognized that the basic test might not be capable of modification for these other purposes.

D. The program of development of any new or modified test should make appropriate use of the information provided by Projects Nos. 6 and 13.

E. Other details that should be considered in setting up a research project are:

a. Tests in which the corrosive medium is condensed from a controlled atmosphere might be used instead of a spray or fog test.

b. The electrical conductivity of films formed on the surfaces being tested should be studied, and preferably the conductivity of the films formed in a test should approximate that of films encountered in practice.

c. Test panels of the Hull-cell type covering graduations of thickness are likely to be useful in correlation tests.

d. The final proof of the value of a test should be based on correlation with performance on car parts. Exposure of test panels on cars might well be carried out as part of a test program.

6. No recommendations are made as to organizations qualified to carry out the proposed project. However, it is suggested that valuable information on the nature of the films that form on plated surfaces in the Detroit area during the winter months might be secured by organizing a cooperative research program under the sponsorship of the A. E. S. This program would be executed by delegates from interested organizations in the Detroit area.

7. It is noted that at the present time any research program directed towards improvement of the value of accelerated tests of plated coatings could very well be justified.

8. While recognizing the usefulness of accelerated tests for appraising the merits of protective coatings, the Committee realizes that the ultimate improvement in protective coatings will require the use of other testing techniques. These should be developed as required to study individually the critical properties of coatings, such as thickness, porosity (micro as well as macro), continuity, uniformity, ductility, stress and adhesion. When such techniques have reached a reasonable stage of development, their relationship to performance in long time natural exposure tests and in actual service should be established. In the course of such an overall program, the advantages and limitations of presently used or proposed accelerated tests could be appraised. The Committee is not recommending that such an overall program be initiated at this time, but is drawing attention to these details so that they may be taken into account in the future development of the research program of the Society.

There are appended for reference three items as follows:

a. A copy of the questionnaire circulated by the Chairman to secure the views of the members of the Committee on certain details of the general subject.

b. A copy of the summary by the Chairman of the several replies to this questionnaire.

c. A resume of certain comments on the present salt-spray test that came out during discussions of the subject.

Respectfully submitted on behalf of the Committee

F. L. LaQue
Chairman

October 30, 1951

*This report has been accepted by the A. E. S. Research Committee, which congratulated the Advisory Committee on the excellence of its work. The Research Committee adopted the policy of pre-evaluating each proposed project in this fashion, with the present report being considered a model for future advisory committees. Project No. 15, "The Study of Accelerated Corrosion Tests", will be activated as soon as a Project Committee is appointed by the Vice-Chairman, Research, Mr. W. L. Pinner.

Washington Orders

Copies of NPA orders and publications may be obtained from National Production Authority, Washington 25, D. C., or from any of its local offices.

Chemicals.—NPA Regulation 2, Direction 3, was amended on December 3 to limit the use of ratings for acquisition of chemicals to those with program identifications A, B, C, and E plus one digit and Z-1.

Copper.—An amendment of November 29 of CMP Regulation 1 and Directions widens the scope of the definition of controlled materials. It also increases the quantities of such materials for which manufacturers of Class B products can self-certify their orders for second-quarter, 1952, delivery (from 500 to 3,000 lb of copper and copper-base alloy). Other changes pertain to the acceptance of carry-over orders, return of unused balances of controlled materials, prohibition of manufacture of products containing CMP materials without an authorized production schedule, lead time for placing orders, and minimum mill quantities.

NPA Form 148 has been gotten up to assist persons in placing authorized-controlled-materials orders. It should be used only on repeated failure to place an order.

The copper-scrap supply, normally 54-60 million pounds per month, was estimated at only 38 million pounds for December, 1951.

The estimated 1952 production of refined copper from domestic ore is 1,005,000 short tons, compared to 933,000 short tons in 1951.

Hoarding.—NPA Notice 1 was amended on November 7 to prohibit hoarding of a number of materials, including alcohol, copper chemicals, artificial-graphite electrodes, army and numbered cotton duck, and steel shipping containers.

Hydrofluoric acid.—Estimated requirements in 1952 for the 100 per cent product are 105 million pounds, against a production of 95 million pounds.

Lead.—Labor shortages at lead mines in the Pacific Northwest have reduced domestic production appreciably. An additional import of 8,500 tons per month is envisaged from Canada as a result of the rise in the ceiling price of imported lead from 17 to 19 cents per lb. November allocations of 28,000 tons was less than half the estimated requirement of 60,000 tons.

Rubber.—Restrictions on consumption of "total new rubber" will be largely eliminated after January 1.

Sodium phosphates.—The NPA believes that the supply will be adequate in 1952. Expansion of facilities now contemplated will increase the capacity by some 60 per cent in 1953.

Tin.—On November 15 there were 11,340 tons of tin in the RFC stock pile, and only 7,500 tons were of grade A. The only other source available for industrial use is the Texas City smelter, which produces 1600–1700 tons per month. World-wide production during the first eight months of 1951, however, exceeded consumption by 18,400 long tons.

Zinc.—Order M-9 was amended on November 23. This Amendment 1, which goes into effect on January 1, redefines slab zinc to include anodes resulting from the first pouring or casting by a producer. The small-order exemption from the allocation-authorization requirement is reduced from 20 to 10 tons total receipt per month. Delivery is prohibited to known violators of order M-15 or other applicable orders. Records must henceforth be preserved for 3 instead of 2 years. Public health and safety, civilian defense, dislocation and unemployment of labor are given special consideration when requests for adjustment or exception are reviewed.

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METAL FINISHING PRODUCTIVITY REPORT

The British Specialist Team on Metal Finishing that visited the United States in 1950 under the auspices of the Anglo-American Council on Productivity has now issued a 75-page report.

Acknowledgment is made to the ECA for technical assistance, to the many firms that opened their doors, to members of the New York, Grand Rapids and Detroit Branches of the American Electroplaters' Society for their hospitality, and, very specially, to Dr. A. Kenneth Graham, the Society's then Executive Secretary, for helpful briefing.

There is much of interest in this report also to the American reader, and hence we shall quote here from the portions of the conclusions reached by the Team.

Copies of the complete "Metal Finishing Productivity Report" are obtainable from the Anglo-American Council on Productivity, 21 Tothill Street, London S. W. 1, England, at 3s.2d. each.

"In the U. S., the finishing operation is almost invariably regarded as an *integral part* of the production line and is planned with the same degree of thoroughness as the press shop or tool room. There was a refreshing *boldness in planning* and a readiness to tear out obsolete plant as soon as a watertight case had been made for scrapping it. The well-known American enthusiasm for new ideas probably accounted for the ready manner in which the technical staff was concentrated on specific jobs so that difficulties could be overcome with the least possible delay. Generally there seemed a greater appreciation by management of the *technical viewpoint*, attributable perhaps to the greater proportion of technically knowledgeable people at the higher levels. *Technical service* by the supply houses also is more highly developed than in this country.

"A high degree of *mechanisation*, made possible by specialized finishing lines, was everywhere apparent. Considerable savings in man-power and greater consistency were thus obtained, all with the full co-operation of the operator, who did not seem to fear the arrival of new machines. The American worker, because he is a believer in the profit motive, has no objection to helping his employer to make more money, so long as his own wage packet increases at the same time. All ranks in industry appear to be *cost-conscious*, and a real effort is made by managements to disseminate cost data to all supervisory grades. In some cases the operators were kept aware of certain aspects of departmental costs. . . .

"It is a deplorable fact that the liaison between *design* and finishing departments is no better in the U. S. than in this country. Only in rare cases could we find that the finishing department had been consulted at any stage in the design of a product; too often last-minute modifications in design had to be made owing to the sheer impossibility of getting an economical finish.

"The condition of the *metal surface* has a considerable effect on the cost of obtaining an agreed standard of finish. We found that surfaces of zinc-base diecastings and rolled brass strip were better than is usual in this country and that much wider use was made of high-grade bright-rolled sheet steel. It might be said that the surfaces were worthy of a finish of better appearance than they, in fact, received. However, American *standards of finish* are very different from ours; if an article is not normally subjected to scrutiny at close range, what is called the "kerb-side" standard is adopted—as long as the performance does not suffer, minor imperfections and blemishes on the surface are tolerated. . . .

"*Process control* was recognized at all levels from production manager to foreman as a vital part of the manufacturing operation. Inspection in general was careful and realistic; one feature which recommended itself to us was the emphasis placed on inspection in the early stages of manufacture, often by production personnel, which led not only to speedy rectification of defects but also the quick removal of the cause of the trouble. Quality control seems to be firmly established as a valuable adjunct to inspection.

"In America, *accident prevention* and the maintenance of healthy working conditions are on the whole subordinated to the demands of production, though there is evidence of rather greater attention than in Britain to the reduction of *operator fatigue* in manual operations. There was a considerable interest in Britain safety regulations and standards.

"Reduction of *polishing* costs by direct and indirect means is a dominating feature of American metal finishing practice. Automatic and semiautomatic polishing machines are used much more extensively than here, and this not only reduces the cost of polishing but also eases the labour demand—a factor of particular importance in the U. K., where for some years there has been an acute shortage of polishers. American practice in this respect is of course favoured by the large outputs and long runs which justify the design and manufacture of specialised polishing machinery, which, in consequence, is more readily available than here. Also noteworthy is the increasing use of *spray-polishing* compounds, which provide a further step towards the complete mechanisation of the polishing process. For small parts, *barrel deburring* and barrel polishing are widely used and have reached a high stage of technical development.

"Indirect methods of reducing polishing costs are also practised extensively. Thus, a *copper undercoat* is used on unpolished or partly polished steel components, primarily on account of the greater ease with which copper may be 'polished' as compared with steel; as a further aid to 'polishing', bright or semibright copper solutions are employed on a very large scale, particularly in the motor industry, and these give the added advantage of high rates of deposition. *Periodic reverse copper plating* is finding increasing favour for the same purpose.

"The American approach to the problem of reducing polishing costs is further illustrated by the practice, fairly extensive there, of using *pre-polished strip* for forming components which are then plated without further polishing. The strip may be polished either by the metal supplier or by the user.

"*Electropolishing* or chemical *bright dipping* prior to plating or anodizing are being developed in an attempt to reduce polishing costs. The large-scale application of electrobrightening of steel in association with semibright-nickel plating and electropolishing of the nickel for the production of bumpers is an isolated but notable example.

"The thoroughness of American *cleaning* cycles prior to plating and of *rinsing* facilities was striking. There is no doubt that American practice is superior to average British practice in this respect, and it may well be that the relatively trouble-free operation of their large, fully automatic bright-nickel installations derives from this fact. A particular instance of some importance is the almost universal use of cleaning and *activating* cycles interposed between nickel and chromium plating. . . .

"The almost complete replacement in the U. S. of solvent-vapour *degreasing* by alkaline cleaners of various types constitutes a marked difference between British and American plating practice.

"The most striking difference in the *plating methods* in the two countries is the more intensive mechanisation in America. The slower progress in *mechanisation* in this country is probably due to the difficulty of justifying the expense of specialised equipment with the smaller outputs prevailing, rather than to any inherent lack of enterprise on the part of British users and equipment manufacturers. Manually operated plants are rarely used in the U. S., and the automatic machines are often fitted with special devices to suit the requirements of the particular

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job. The use of such machines . . . favours the maintenance of a more consistent standard of quality. . . .

"Ingenuity in the use of associated groups of automatic and semiautomatic machines to promote flexibility of production and to economise in equipment and floor space was observed on several occasions; for example, the arrangement of three automatic plating machines to produce alternative thicknesses of copper undercoat for a copper-nickel-chromium finish on different components, and the use of an old automatic machine to serve as a common cleaning unit for a number of different semiautomatic plating processes.

"*Electroplating solutions* and conditions of operation are in general similar to those here but there are noteworthy exceptions. Thus, bright- and semibright-copper plating solutions are widely used, and dull-nickel plating has been almost entirely discarded in favour of the bright processes, and the organic processes in particular. Semibright-nickel plating followed by light polishing is an established practice. Deionised water is sometimes used for the preparation and make-up of plating solutions and for rinsing.

"*Barrel-plating* equipment and technique are highly developed in the U. S., and it seems likely that the quality of barrel plating is higher and more consistent than the average British standard.

"Another interesting feature of American electroplating is the growing use of the *periodic-reversal process*. The value of P. R. plating must be judged in relation to the saving in cost of labour and machinery for mechanical polishing, which promises to be substantial. From this point of view P. R. is potentially valuable as an aid to productivity, but the increase in current consumption resulting from the low effective efficiency must be weighed against the power saved in the polishing operation. The cost and difficulty of converting existing plant to the P. R. process must also be borne in mind. The process is being operated with apparent success in a limited number of American plants on a large commercial scale. . . . the adoption of P. R. copper plating may solve many of the problems presented by the current nickel shortage. The P. R. process may also be valuable in specialised applications requiring very thick deposits.

"In *research and development* the American plating trade is in certain respects more favourably situated than its British counterpart. The wide scope of the work and publications of the American Society for Testing Materials, the marshalling and co-ordination of forces provided by the Research Scheme of the American Electroplaters' Society, and the immediate open publication of the research results have no true parallel in this country. These factors must in the long run prove of great benefit to the American plating industry at large."

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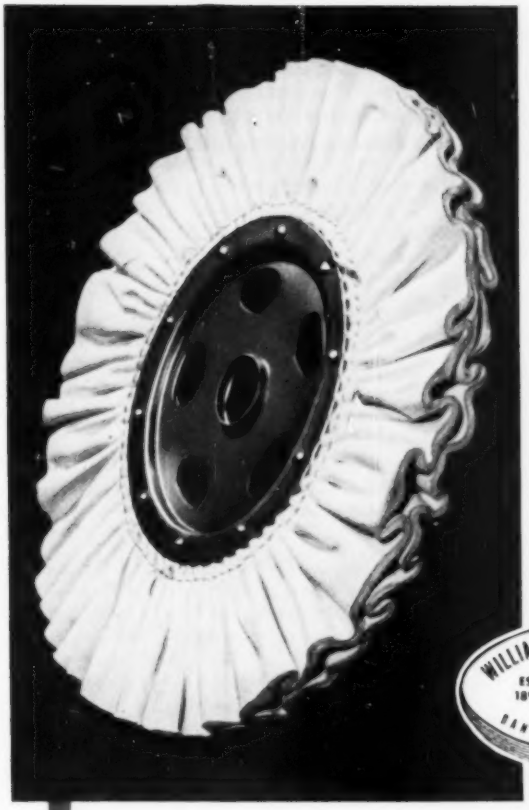

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QUESTION BOX

readers' questions of general interest

Q. 132. Is there rapid and practical plant method for determining the contents of iron and free sulfuric acid in a 10 per cent by volume sulfuric acid pickle?

A. The following method applies to the analysis of both sulfuric and muriatic acid pickling baths:

Acid Content: (1) Pipette a 1-ml sample into a 250-ml Erlenmeyer flask; (2) add about 10 ml distilled water; (3) add 3 drops of brome-phenol-blue-indicator solution (5 g per liter of ethyl alcohol); (4) titrate with a 0.479-N sodium carbonate solution (9.50 g/l of special anhydrous salt) till the color changes from green to purple or blue; (5) percentage by volume of 18° Baumé muriatic acid = 2 x ml standard solution used; percentage by volume of 66° Baumé sulfuric acid = 0.5 x ml standard solution used.

Iron Content: (1) Pour about 10 ml of 5 per cent by volume concentrated sulfuric acid into a 250-ml Erlenmeyer flask; (2) add 1 drop of a 0.025-*M* orthophenanthroline indicator solution; (3) Pipette 1 ml pickling acid into the flask; (4) Titrate with a 0.0895-N ceric ammonium sulfate solution (56.6 g/l $Ce(SO_4)_2 \cdot 2(NH_4)_2SO_4 \cdot 2H_2O$, standardized against sodium oxalate) until the color changes from red to blue or green; (5) percentage of iron = 0.5 x ml standard solution used; g/l iron = 5 times ml standard solution used.—K. G. Soderberg.

Q. 133. From time to time we have encountered "spalling out" on our brass plated zinc-base diecastings. Is such a condition unavoidable, owing to the nature of diecastings, or can it be overcome by preliminary mechanical treatment, special cleaners or dips, or by subsequent chemical dips or other methods?

A. Such a condition is not unavoidable; in fact, it should not exist. Assuming that your brass plated diecastings are lacquered or clear enameled immediately after plating, the spotting is caused by the "bleeding out" of solution trapped in pores. Assuming that the brass plate is of good quality, and that the cleaning cycle is reasonably good, the pores originate in the base metal. In such case, either the castings are of inferior quality, or the treatment before plating is faulty.

The best treatment depends upon the quality of the castings. With good castings, a good buff job is best; preliminary polishing is apt to do harm by opening up sub-surface pores. If certain surface defects exist, it is possible that a very fine polishing operation prior to buffing will give the better results. On pieces having irregular contours, this may be done with a soft muslin wheel, using greaseless polishing composition. Experimenting will quickly give the answer.

Extremely thorough rinsing after plating will minimize the condition, but probably not eliminate it. A copper underplate might help.

We recommend that you read the Bureau of Standards Research Paper No. 72, published in the J. Research Natl. Bur. Standards 2, 1085 (1929). This paper is probably available from the Superintendent of Documents, Washington 25, D. C., at 10 cents.—L. B. Sperry.

Q. 134. My silver solution climbs up tank walls and anodes and forms incrustations over the edge of the tank and on anode rods. How can I stop this waste and nuisance?

A. Smear some silicone grease across the path of the climbing solution. It is not wetted by the solution, and hence stops the climbing. Contrary to ordinary grease, it does not contaminate the plating solution.—K. G. Soderberg.

Q. 135. We have tried different methods of cleaning and zinc plating heat-treated steel spring clips. One has been tumbling in muriatic acid and barrel plating; another has been racking the parts, muriatic pickling and plating; a third, sulfuric acid pickling, water rinse, cyanide rinse and still plating. Although we get a bright finish, the parts are all blistered. Sometimes the blisters do not show up until the parts have been baked, which we do immediately after plating at 300° for 2 hours. Any information you may be able to give us would be most appreciated.

A. The difficulty is undoubtedly associated with absorption of hydrogen during the plating cycle and subsequent release of the hydrogen gas underneath the zinc film, producing blistering. One important source of hydrogen is acid pickling. In my experience, hardened parts should be freed from oxide by wet tumbling in sharp sand or other abrasive. You may possibly add a little niter cake to speed the action.

I would not do any cathodic electrolytic cleaning; if cleaning were necessary, I would either degrease in chlorinated solvents or tumble the parts in a soak-type cleaner.

A source of hydrogen is the zinc plating operation itself. This subject was discussed by C. A. Zapffe and M. E. Haslem in an article that appeared in the April, 1950 issue of Plating. It showed, and this agrees with practical experience, that an acid zinc plating bath will give much less embrittlement than a cyanide zinc plating bath. Some differences were observed between the different cyanide zinc plating processes.

Too rapid heating after plating, as well as too high a temperature of heating, might help to produce blisters. The temperature you use of 300° F. however, appears very reasonable.—K. G. Soderberg.

Book Review

DR. HAROLD J. READ
Associate Professor of Metallurgy, Pennsylvania State College

ELECTROPLATING—A Survey of Modern Practice, by Samuel Field and A. Dudley Weill, 6th edition, 1951, ix + 546 pages. Pitman Publishing Corporation, 2 W. 45th Street, New York 19, N. Y. Price, $6.00.

The fifth edition of this book was reviewed in this column in December, 1945. The critical remarks made at that time concerning the general character of the text apply to the new edition, for aside from the addition of two chapters, there have been no major changes in the volume.

The new chapters are concerned with electrolytic polishing and with the finishing of aluminum and magnesium. The brief section on electropolishing is a moderately satisfactory survey of polishing solutions and techniques, but the discussion of the economic position of the process is superficial. Electroplating on aluminum and magnesium alloys is given but scant attention in the second new chapter. The more recent literature has been neglected, and there is little of real value to the electroplater.

Throughout the entire volume the authors make no reference to any published information later than 1947, a circumstance which appears inexcusable in a volume published in 1951. The tendency of the authors to be somewhat behind the times is evident in many places, e. g., no mention is made of fluoborate solutions, the methods for determination of *p*H do not include any electrometric techniques, and the desirability of purifying cyanide zinc solutions is not mentioned. The most serious omission, however, is in the field of nickel plating where the tremendous accomplishments of the last decade in purification, filtration and the general handling of nickel solutions have been ignored.

Aside from the two new chapters, the other revisions are limited for the most part to additional paragraphs here and there throughout the text. Little or no obsolete material has been removed, and many of the chapters on practical methods are in need of a sweeping purge. The book, in general, is worthy of more attention than its authors have given to the revision, for it is quite well organized, easy to read, and sufficiently comprehensive for its intended purpose.

The reviewer does not feel that a book of this sort needs to include every variation of standard practice which may currently be suggested and which may enjoy a passing vogue, but any volume which purports to "explain and illustrate the latest methods used in this progressive industry" must take cognizance of those recent developments which have taken a firm place in commercial practice. If such developments are not utilized in the authors' own country, there is still no reason for their omission from a book which is to be given international distribution.

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- ¶ What rinsing fault is "an invitation to trouble" in the plating of high-carbon steel? *See page 11.*
- ¶ Why is it better to clean steel with reverse current than with direct current? *See pages 12 to 14.*
- ¶ What causes hydrogen embrittlement during electrocleaning? What is the remedy? *See pages 15 and 16.*
- ¶ One part chromic acid in 1,000,000 parts of cleaning solution—does that spell D-A-N-G-E-R? *See page 16.*
- ¶ How can an ordinary electrocleaning cycle be transformed into an exceptionally good cycle? *See Cycle E on page 23.*

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Article Abstracts

No copies of articles are available at the offices of "Plating". Photostats may be had from libraries having files of the journal in question and offering photostat service, usually at 30-50 cents a page. Ask your public library to consult the Union List for names of libraries having the particular journal. Abbreviations used are those of Chemical Abstracts.

Flame Sprayed Plastic Coatings. B. Goldberg. Corrosion 7, 47–50 (February, 1951).

The history of flame spraying is reviewed briefly. Both guns and powder containers used for applying coatings of plastic powders are described in some detail. Necessary criteria for organic materials, both thermoplastic and thermosetting, are indicated. Problems involved in producing suitable powders of tough, nonfriable resins are discussed and indications given of several promising solutions. Properties of flame-sprayed Thiokol coatings are reviewed in some detail. Recent work on improvements in flame-spraying technique is illustrated by a discussion of the advances in the flame-spraying of various polyethylene compounds. This includes comments on current theory, various fuel-gas combinations, and polyethylene compounding for obtaining specific properties. Some data are presented on the effect of after-treatments of the coatings. Experimental work being done on producing coatings of fluorinated hydrocarbons is described, and a preliminary report given on the properties of these coatings. Recent developments in the technique for producing smooth, nonporous coatings of hot-melt composition are discussed in some detail. The history of several successful applications is reviewed.

Modern Masking Materials and Methods for Fabrication and Spray Finishing. A. P. Schulze. Products Finishing **14**, 20 (August, 1950); 26 (September, 1950); **15**, 23 (October, 1950); 44 (November, 1950).

The development of pressure-sensitive tapes, die-cut stencils, and papers to be used for masking a wide variety of products to facilitate spray finishing and decorating is covered in Part I. Characteristics of the various masking devices and products are described. A number of references to the literature are made. In Part II many interesting applications for these masking devices are presented. The shop man with a masking problem can thus select a method of masking which will solve his particular problem. Examples are cited of the use of masking materials to protect prepolished metal during fabrication, as well as to facilitate spray decoration of manufactured products. High production repetitive spraying of designs on manufactured products can be accomplished through the use of metal shields and electroformed masks. Part III describes the various types of masks used for this purpose and discusses the characteristics and advantages of these types. Part IV shows that for some spray fin-

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Article Abstracts

ishing purposes, liquid masking materials applied by brush or spray offer advantages not found in pressure-sensitive tapes or metal masks. Materials of this nature are discussed as to their characteristics and applications in this final part of the article. Peelable plastic coatings are also applied by spraying to polished sheets which are to be formed and drawn. The plastic film protects the sheet from die marks and can be peeled off the product after its fabrication. The third general use for liquid masking materials and peelable plastic coatings discussed in this article is that of coating paint-spray booth walls to facilitate periodic maintenance and cleaning operations. A number of products used for this purpose are described and discussed, and a number of references to the literature are cited.

The Surface Treatment of Aluminum and Its Alloys. L.B. Mauderli. Aluminium Suisse, No. 3, 98–105 (May, 1954); Light Metals Bull. **13**, 524 (July 20, 1954).

Following a short general introduction the author presents particulars of different processes (grinding, polishing, tumbling, satinizing, sand blasting, etc.). Recommended finishing sequences for different products are set out in tabular form. Special points and precautions, for example, when dealing with different alloys, in preparing surfaces for anodizing, etc., are mentioned with some references to typical examples.

Structure of Electrolytic Chromium Deposits. O. Lohrman. Lilienthal Gesellschaft Luftfahrtforschung No. 165, 13–15 (1943). Transl. No. 2634, Henry Brutcher, Altadena, Calif.

Chromium deposits with a hexagonal structure were obtained from a solution of 250 g/l (33 oz/gal) CrO_3 and 2.9 g/l (0.38 oz/gal) H_2SO_4 at 55° C (130° F) and 20.4–54.6 amp/dm² (1.3–3.5 asi) of single-phase rectified current. At 70 amp/dm² (4.5 asi) the deposit was largely of cubic structure, unless the temperature was raised to 70° C (158° F). At 20.4 amp/dm² (1.3 asi) and 35° C (95° F) some cubic chromium was also formed. Substantial reduction or increase in H_2SO_4 content also favored the cubic structure, as did superimposition of direct current over the pulsating current. Storage for 10 hours at 148° C (300° F) caused the structure to change from hexagonal to cubic. 22 ref.

Relationship Between Shape and Conditions for Electrodeposition of Metallic Crystals. IV. Effects of Impurities on the Formation of Block Structures in Polycrystalline Deposits. Hellmut Fischer. **V. Effects of Shape and Orientation of the Crystals of the Substrat on Reproduction of the Base.** Hellmut Fischer, Horst Matschke, and Franz Pawlek. Z. Elektrochemie **54**, 459–485 (October, 1950).

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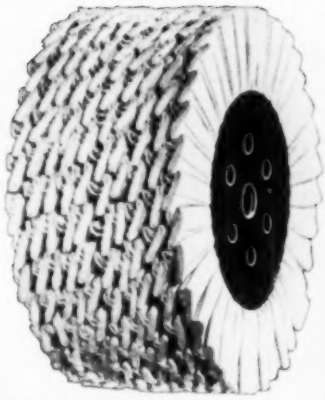

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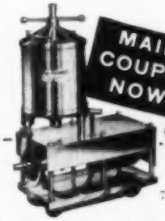

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Article Abstracts

In Part IV, it is shown that shape and orientation of the crystals varies with type and concentration of foreign materials present. Formation of five different shape types is discussed separately. In Part V, experiments on deposition of copper on copper from an acid copper sulfate solution are described. It is shown that extent of reproduction or adaptation of electrodeposit structure to that of the substrate depends mostly on ratio of grain diameter of the deposit to that of the base, and to a lesser extent on grain orientation of the base. Photomicrographs and tables.

A Discussion of Throwing Power. J. Electrodepositor's Tech. Soc. **25**, 77–94 (1950).

"The Measurement of Throwing Power and the Prediction of Thickness Distribution", by G. E. Gardam, is a summarization of the theoretical treatment of throwing power. The author concludes that plate distribution cannot be predicted accurately in the light of present knowledge, and that it is more important to persuade designers to work with the limitations of plate distribution in mind than to have platers try to plate an article which has been poorly designed for plating.

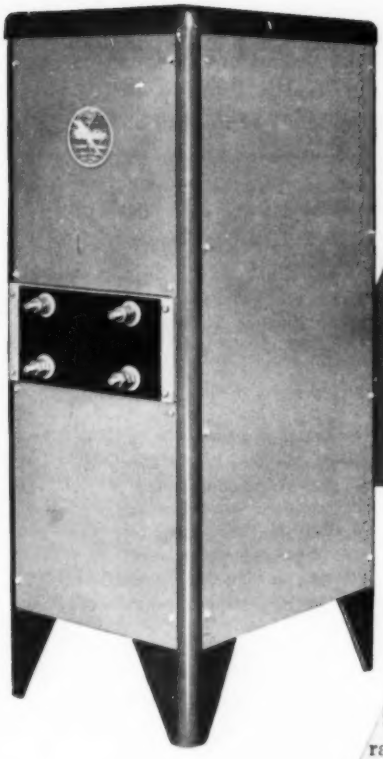
"Throwing Power in Alloy Deposition", by J. W. Cuthbertson. In alloy plating, additional factors further complicate the problem of plate distribution. Not only is thickness-throwing power important, but also composition-throwing power. The basis metal also is frequently a factor in both.

"Practical Implications of Throwing Power", by S. Wernick. As specifications for minimum thickness have increased, there has been a marked tendency toward higher current densities and temperatures, agitation, and higher metal concentrations in the solutions, all of which tend to reduce throwing power and so defeat the desired objective. Nickel is unique in that comparatively heavy thicknesses are demanded and the acid-type solutions used have notoriously poor throwing power. Throwing power was investigated by plating specimens of sheet metal bent into various geometric shapes. Sketches and data are presented and the results discussed. The importance of proper racking and of the necessity for further research are emphasized.

A general discussion followed, in which the importance of the surface condition of the basis metal was repeatedly brought out.—LYMAN B. SPERRY.

Testing Techniques and Uses of Equipment for Evaluating Organic Coatings. R. J. Phair. Paint Varnish Production Mgr. **30**, 8–11 (June, 1950); 12–15, 17–19 (July, 1950).

Part I is concerned with the measurement of coating thickness, distensibility, and adhesion of finishes for metal products. Part II covers mar testing, impact resistance, abrasion and hardness testing.



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Patent Abstracts

GEORGE B. HOGABOOM

Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.

No. 2,563,360, August 7, 1951—Electrodeposition of Copper—W. M. Phillips and F. L. Clifton, assignors to General Motors Corporation.

EXAMPLE 1. 250 grams technical copper sulfate
35 grams cadmium sulfate
10 grams sulfuric acid
10 grams di-chloro-benzene sulphonic acid
0.1 gram thiourea
Water to make one liter

EXAMPLE 2. 250 grams copper sulfate
35 grams nickel phosphate $Ni_3(PO_4)_2.7H_2O$
10 grams sulfuric acid
10 grams phosphoric acid
10 grams naphthylamine disulphonic acid
0.1 gram thiourea
Water to make one liter

EXAMPLE 3. 250 grams copper sulfate
10 grams sulfuric acid
1 cc "Triton 720"
0.01 gram thiourea
Water to make one liter

CLAIM 8. An electrolyte for electrodeposition of copper in a bright or semibright form which consists essentially of an aqueous solution of copper sulfate and sulfuric acid to which has been added, per liter of solution, 0.002 5 grams of thiourea and 10 75 grams of a salt of a metal of the class consisting of cadmium, zinc, nickel and cobalt.

12 claims, 6 examples.

References cited: U. S. Patents 103,947; 1,329,666; 1,903,860; 2,112,818. Alien Property Custodian Publication Ser. No. 351,211, published May 18, 1943, filed August 3, 1940.

No. 2,566,568, September 4, 1951—Method of Treating Electrolytic Coatings—E. S. Taylerson, assignor to United States Steel Company.

CLAIM 1. The method of treating steel strip having a coating of tin electrodeposited thereon in which the strip while in motion as a strand is heated to the melting point of the coating by passing a controlled electric current therethrough, characterized by passing said strip during said heating by said current through a shield of a heat-conducting material around said strip, imparting heat to the outer surface of said shield, controlling the amount of heat imparted to said shield independently of said controlled electric current

through said strip to maintain said shield at a temperature approaching but below the melting point of tin whereby a uniform melting of the tin coating across the width of the strip is achieved and control of said melting remains in the aforementioned controlled current, and quenching the strip immediately after the tin coating becomes molten.

6 claims, 2 figures.

References cited: U. S. Patents 482,879; 496,208; 1,495,175; 1,799,102; 2,085,543; 2,357,126; 2,418,087. British Patents 258,633; 458,940. French Patent 807,170.

No. 2,566,676, September 4, 1951—Electrodeposition Apparatus—A. T. Rabbitts, assignor to His Majesty the King as represented by Minister of Mines and Resources.

CLAIM 1. An electrodeposition apparatus comprising a frame having a horizontally disposed upper wall, a cylindrical vessel closed at the bottom and open at the top supported on said wall, means mounted on the wall for holding the vessel in fixed position, a stirring member in the vessel, means below the wall and removed from the stirring member for magnetically rotating the latter, a vertically disposed frame member rearwardly of the wall and in fixed relation thereto, an electrode holder slidably mounted on said frame member in rearwardly opposite relation to the vessel, said holder being slidable in a vertical direction, resilient means releasably holding the electrode holder in selected fixed position on the frame member to permit vertical adjustment thereof, an arm carried by the holder, a pair of insulated jacks mounted on the arm, means electrically connecting the jacks to a source of electric current, a twin electric plug seated in said jacks, a pair of substantially rigid wires electrically connected to said plug and carried thereby, each said wire having a portion extending forwardly from said plug over the mouth of the vessel and a portion extending downwardly into the vessel, an electrode carried on the downwardly extending portion of each wire and located in the vessel, and an imperforate closure plate freely seated on the mouth of the vessel over said wires, said holder on removal of said closure plate being vertically slidable to withdraw the electrodes from the vessel, and said plug with said wires and electrodes being unitarily removable from said jacks and holder.

3 claims, 7 figures.

References cited: U. S. Patent 479,557. Swiss Patent 142,020. British Patent 430,635. "Electrolytic Methods of Analysis", Neuman (1898), pp. 84 and 85. "Electro-Analysis", 4th ed., Smith (1907), pp. 49–51, 59–61. Trans. Electrochem. Soc. **32**, 329–334 (1917). Ind. Eng. Chem., Anal. Ed. **14**, No. 11, 907 (November 15, 1942).

No. 2,567,934, September 18, 1951—Process of Electrodepositing Alloy of Lead and Indium—D. F. Green,

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N. P. Mallet and J. McK. Briscoe, London, England, assignors to Vanderveil Products Limited, London, England.

CLAIM 1. A process of electrodepositing an alloy of lead and indium which comprises the steps of preparing a nonaqueous solution of about 20 grams per liter of indium as perchlorate and 1 to 12 grams per liter of lead as perchlorate, dissolved in ethoxyethyl alcohol, passing a current through the electrodes while maintaining the cathode current density at about 7 to 10 amperes per square foot, the alloy electrodeposited ranging from 90 to 1 per cent indium and the balance lead, the anode containing an alloy of lead and indium with slightly higher percentage of indium than in the deposit, and maintaining the bath temperature at from 60 to 80° C.

CLAIM 2. . . . a nonaqueous solution of about 20 grams per liter of indium as perchlorate and 5 to 12 grams per liter of lead as perchlorate. . .

2 claims, 4 examples.

References cited: U. S. Patents 931,944; 1,935,630; 2,139,935. Chaney et al., J. Phys. Chem. **35**, 2294, 2295, 2306, 2310–2313 (1931). Mathers et al., Trans. Am. Electrochem. Soc. **26**, 133–135 (1914). "Handbook of Chemistry and Physics", 26th ed. (1942–1943), p. 1360.

No. 2,568,780, September 25, 1951. Rectifier Manufacturing and Products Obtained Thereby. *A. Von Hippel and Mortimer C. Bloom, assignors to Federal Telephone & Radio Corporation of America.*

CLAIM 10. The process comprises electrolytically depositing gray crystalline metallic selenium upon an electrical conductor as the cathode during electrolysis of a highly concentrated aqueous solution of selenium dioxide having a high concentration of sulfuric acid dissolved therein, using a current density of approximately 10 amperes per square foot of cathode surface during the initial period of electrolysis and thereafter increasing the current density to cause discharge of gray crystalline metallic selenium at a desired rate without evolution of hydrogen at the cathode, at least the initial period of said electrolysis being conducted at a temperature in the range of about 75° C to about 125° C.

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Patent Abstracts

10 claims, 3 figures, 11 examples.

References cited: U. S. Patents 1,743,160; 2,030,443; 2,378,513; 2,414,438. G. Sella, Ricerca Sci. **10**, 1143-1144 (1939). Chem. Abs. **34**, 2713 (1940).

No. 2,574,225, November 6, 1951—Process for Rendering Metal Surfaces Antiseptic and Products Therefrom—W. F. Ringk and S. K. Freeman, assignors to Berizol Products Company, Newark, N. J.

It is known that bacterial and other growths may occur on metal surfaces of articles such as containers for cosmetics, food, etc., on metal articles and structural parts used in the brewing, dairy and pharmaceutical industries, and on optical articles such as cameras, telescopes, range finders, etc.

CLAIM 14. A process for coating metals which comprises anodizing a metal selected from the group of aluminum, magnesium, tin and zinc to form a coating of the corresponding oxide, immersing the coated material in a solution of 0.1 to 0.5 per cent of a quinolinol substance selected from the group consisting of 8-quinolinol, a salt thereof, a nuclear-substituted 8-quinolinol, a salt thereof in a *p*H range of about 4.5 to about 12 at a temperature within the range from about 120–140° C for a period of about 10 to 20 minutes together with a dye capable of dyeing said oxide coating, and forming a compound between said oxide and said quinolinol substance thereby forming a bond between said metal, said oxide and said quinolinol substance.

22 claims, 31 examples.

References cited: U. S. Patents 1,923,539; 2,150,409; 2,381,863; 2,431,291. British Patent 523,837. J. Soc. Chem. Ind. **59**, 34, 35, 38, 39 (1940).

No. 2,574,305, November 6, 1951—Activating Process for Plating—Robert M. Wagner, assignor to General Motors Corporation.

CLAIM 1. A process for activating a metallic part having a plating of chromium thereon so that an adherent, metallic coating may be electrodeposited thereover which consists essentially in making the chromium plated part the cathode in a solution consisting essentially of 6 to 32 ounces of nickel sulfate and 6 to 32 fluid ounces of commercial concentrated hydrochloric acid per gallon of water, and passing direct current from a nickel anode through said solution to the chromium plated part at a cathode current density within the range of 15 to 150 amperes per square foot for a time within the range of approximately 10 to 30 seconds, said solution having a temperature within the range of approximately 70–125° F.

5 claims.

References cited: U. S. Patents 1,746,987; 1,774,901; 2,118,956; 2,285,548; 2,358,995; 2,437,409; 2,491,126; J. Electrodepositors' Tech. Soc. **9**, 125, 126, 131, 132 (1933–1934). Trans. Electrochem. Soc. **37**, 427–434, 443, 447, 449 (1940); **88**, 335–355 (1946).

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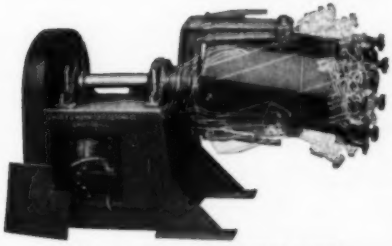

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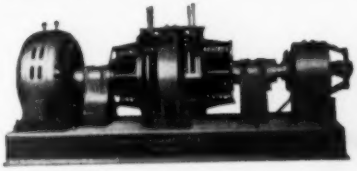

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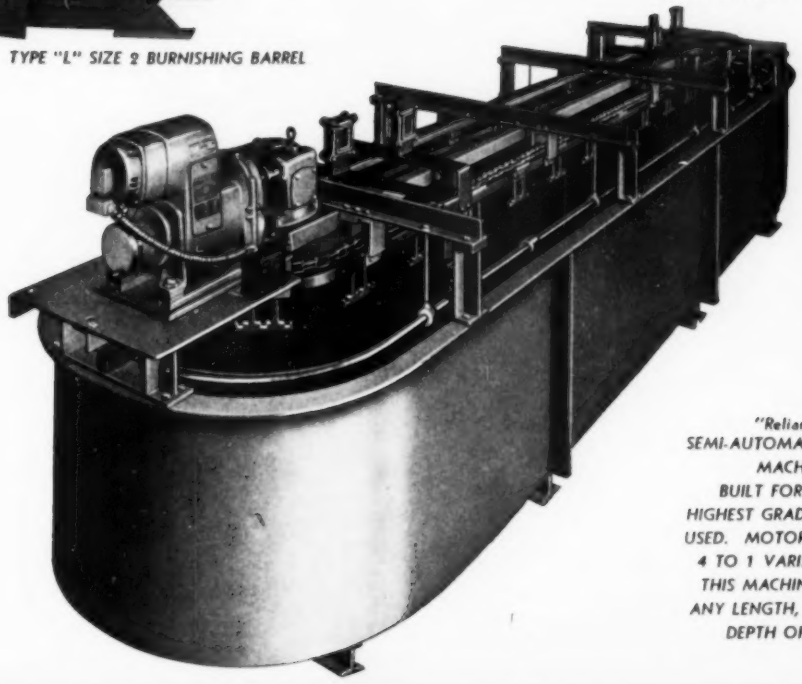

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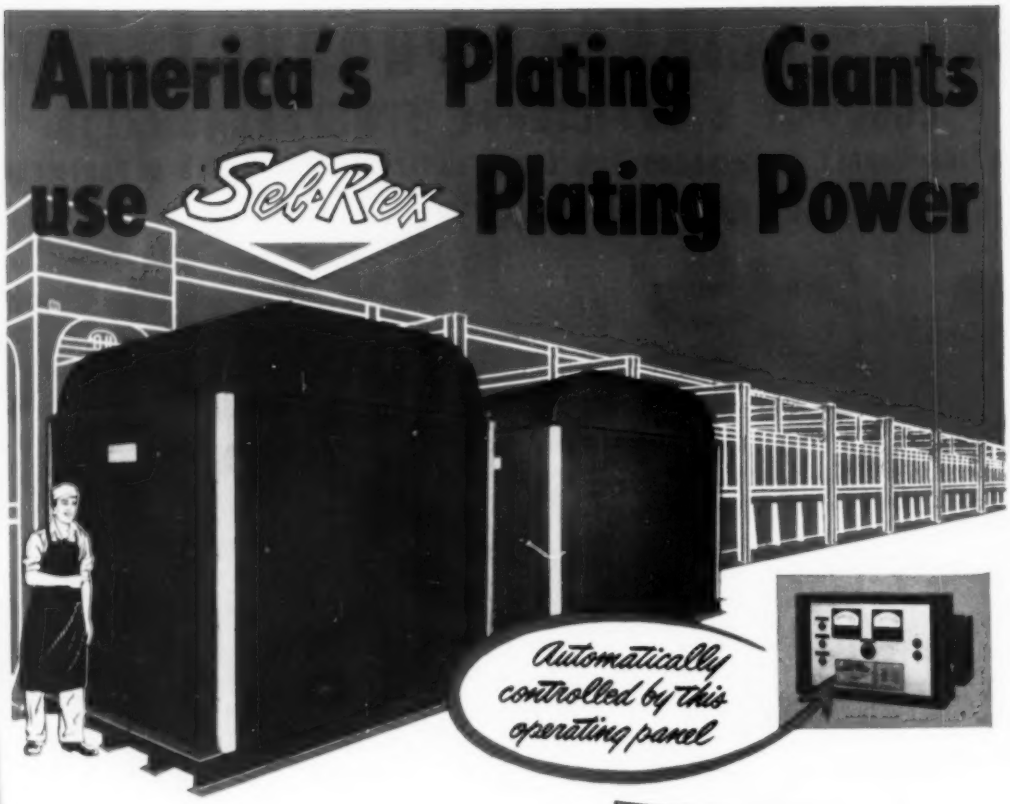

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A.E.S. News

Additional Supporters of the Canadian Research Project

We regret that the list of sustaining members in Canada published in the December issue was incomplete because of a clerical error. We are pleased to add the following names:

The Steel Company of Canada Ltd., Hamilton, Ontario
F. B. Stevens of Canada Ltd., Toronto
Thomas Buff & Brueck Company Ltd., Hamilton, Ontario
Tools & Hardware Ltd., Orillia, Ontario
Union Screen Plate Company of Canada Ltd., Lennoxville, Quebec
W. W. Wells, Ltd., Toronto

New Sustaining Members

Two more companies have become sustaining members of the Society for the support of its research program:

The Autoyre Company, Oakville, Conn.
Whitney Blake Company, Hamden, Conn.

Chicago Convention Papers

Papers are invited for presentation at the Chicago Convention, June 16-20, 1952.

Prospective authors are urged to write at once to the American Electroplaters' Society, Box 168, Jenkintown, Pa., for the "Offer Form", "Regulations Governing Articles and Papers", "Instructions to Authors" and "Presentation of Papers".

Papers submitted to the same address by January 15, 1952, will be considered by the Society's Editorial Board for presentation at the Convention.

✝ Louis A. Delamothe ✝

The San Francisco Branch lost one of its most able supporters when Louis A. Delamothe passed away on September 25, 1951. He suffered a stroke while working in his shop, was taken to the hospital, and never regained consciousness.

Delamothe was born in New York State in 1890 and came to California in 1913. Here he opened the Oakland Plating Works, which he operated until his death as a job shop specializing in silver. He was known nationally for his outstanding achievements in the plating on nonmetallics.

Delamothe was a charter member of the San Francisco Branch, having assisted in its organization in 1935, and served as chairman of its Board of Managers for several years.

His many friends and associates join his widow, Catherine, his son Armand, and his daughter, Mary Louise, in their mourning.

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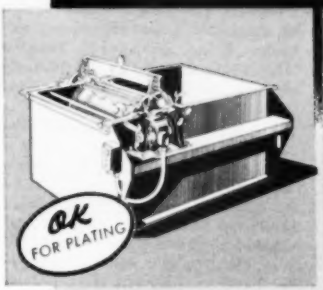

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Branch News

COMING EVENTS

CHICAGO BRANCH

At our November meeting, the General Chairman of our Annual Banquet and Educational Session, HAROLD SMALLMAN, gave a report on progress made. The affair will take place on Saturday, January 26, in the Conrad Hilton Hotel (formerly the Stevens), and will be on a par with, if not better than, last year's.

The speakers for the Educational Session and their subjects will be:

R. M. MACINTOSH, of the Tin Research Institute, "Speculum Plating"

A. E. CHESTER, of Pronat Division, Poor & Company, "White Alloy Plating"

D. B. MESERVE, of United Chromium, Inc., "Organic Finishes of Plated Surfaces"

The Branch extends an invitation to Society members and all others interested in metal finishing to come to this affair.

J. M. ANDRUS, *Librarian*

NEW YORK BRANCH

ANNUAL EDUCATIONAL MEETING
AND BANQUET
Statler Hotel
Saturday, February 16

Educational Session at 2:00 P. M.

DR. LOUIS WEISBERG, "Recent Developments in Plating Waste Disposal"

DR. R. B. SALTONSTALL, The Udylite Corporation—Subject to be announced

GUSTAF SODERBERG, Editor, PLATING, "Some Fundamentals of Zinc and Cadmium Plating"

Banquet at 7:00 P. M.

BALTIMORE-WASHINGTON BRANCH

The November meeting was a dinner meeting held at the Hotel 2400 in Washington, D. C.

A. E. S. PRESIDENT CLEVELAND F. NIXON was the honor guest, and was inducted into the "The Order of the Pot" by A. E. S. Past President KEN HUSTON.

DR. W. BLUM, who is retiring from the National Bureau of Standards at the year's end, was honored by TOM SLATTERY, who briefly reviewed Dr. Blum's life and Tom's own association with him. BRANCH PRESIDENT DR. LAMB presented Dr. Blum with a rod and reel as a small token of appreciation for his services to the local Branch and the Society as a whole.

Mr. Nixon discussed the substitute finishes now being used and those considered for use to replace critical metals.

V. F. HUGHES, JR., *Secretary*

CINCINNATI BRANCH

After a belated but most enjoyable turkey dinner on November 28, the Branch discussed a number of important items, including a letter from the Chicago Branch suggesting a mid-year meeting. New members and guests had been introduced, and the Branch was informed that VICE-PRESIDENT C. C. CLAYBAUGH was resigning his office because he was leaving the city.

A picnic will be held next summer, preferably on a Saturday in June. STEWART CHIPMAN and RAY BARRY were appointed a Picnic Committee.

The speaker of the evening, A. E. S. Past President S. S. JOHNSTON of Weirton Steel Company, an old friend, was introduced by PRESIDENT ROBERT J. MILLER. Taking "Tin Plating on Wide Strip Steel" as his subject, Mr. Johnston began by showing an excellent movie of the manufacture of steel and its eventual tin plating. He dwelt on both the electrolytic and the hot-dip process and pointed out that the former was only 15 years old. It has since become the most popular, because many canned products only require 40 per cent of the tin put on by the hot-dip process. Mr. Johnston concluded his highly interesting talk by showing slides which illustrated the various methods of plating steel.

BILL YOUNG, manufacturers' representative, served as host for the usual Social Hour which followed.

CHARLES WISE, *Secretary*

DALLAS-FORT WORTH BRANCH

A permanent charter was presented to the Branch at a dinner meeting on October 17 in Sammy's Restaurant. MR. WILLIAM J. NEILL, of Columbus Metal Products Company, A. E. S. Past President, made the presentation, and all members in attendance (there were 32) signed their names to the charter.

Mr. Neill also gave a very good talk dealing with electropolishing of stainless steel and plating on nonconductors, which everyone seemed to enjoy very much.

C. A. WHITE, *Secretary*

DALLAS-FORT WORTH BRANCH

The November 27 meeting was held in the Adolphus Hotel.

The Branch By-Laws that had been written were read and approved by a majority vote. The Secretary will have them printed and distributed to each member.

A committee consisting of BOB HEPPEL, JOHN O'NEAL, A. C. FRICKE, and JAMES WEBB was appointed to find a suitable meeting place between Dallas and Fort Worth for the convenience of all members.

After the business meeting Mr. Heppel showed a film on automatic plating, which was very interesting.

C. A. WHITE, *Secretary*

DAYTON BRANCH

The second meeting of the fall season began with dinner featuring "Chicken-

A. E. S. President C. F. Nixon receives (left) package from A. E. S. Past President Kenneth Huston with Branch President Dr. Lamb looking on, and (center) proudly displays contents, the electroplated pot symbolic of his induction into the organization of A. E. S. presidents. Dr. Brenner presents (right) retirement gifts to Dr. William Blum

in-the-Rough" at a local restaurant.

The speaker for the meeting was MR. J. T. IRWIN, consultant for the Promat Division of Poor and Company, who gave an interesting lecture on the "Acid Phase of Preparation of Basis Metal for Electroplating". With pertinent slides, Mr. Irwin described the phenomena incident to acid pickling, and the polarization and etching occurring therewith. He then described the types and action of inhibitors, which eliminate or reduce the foregoing effects to yield a smooth, and relatively etch-free surface.

In addition, the speaker presented some of the basic principles and applications of white-brass plating as a substitute finish for nickel plating. This discussion was augmented by a display of sample parts.

The assembly continued in informal discussion groups while refreshments and snacks were being served.

PAUL E. GESKE, *Secretary*

DETROIT BRANCH

A regular meeting was held on November 2, in the Statler Hotel, following the customary Board dinner at 6:30 P. M. FRANK L. CLIFTON presided and around 200 members attended.

Featured speaker was MR. FRANK K. SAVAGE, of the Savage-Rowe Plating Company, Kalamazoo, Mich. His talk on "Plating Room Costs" contained much of interest to his listeners.

Replacing the usual December monthly meeting, the Branch held a special technical session on November 30, and its Annual Christmas Dinner Party on December 1.

The Friday night gathering heard four authoritative speakers present a symposium on copper plating: DR. JESSE E. STARECK of United Chromium, Inc.; DR. A. KENNETH GRAHAM of Graham-Crowley & Associates, Inc.; MR. B. C. CASE of Hanson-Van Winkle-Munning Company; and MR. W. P. INNES of General Motors Research Laboratories. DON BIGGE of Chrysler Corporation acted as symposium chairman. A number of out-of-town Society members who were in Detroit for the annual dinner attended the technical meeting.

E. STEEGER, *Publicity Chairman*

GRAND RAPIDS BRANCH

The October meeting was held at the Rowe Hotel on the 12th. There was a good turnout of members to hear MR. A. E. CHESTER, of the Promat Division, Poor and Company, speak on "White Brass Plating". This reporter being absent, he can only say that Dr. Chester's talk was interesting and enlightening.

The meeting was followed by the usual buffet luncheon served at the hotel.

On November 9, during a short business meeting, a resolution introduced by LYMAN SPERRY was passed to give cash awards to authors from the Branch whose papers are accepted for reading before the Branch or a Convention or are published in PLATING.

ASSISTANT LIBRARIAN FRANK BADALUCO introduced MR. ART LINN, United Chromium, Inc., who spoke on copper-chromium plating. Mr. Linn first reviewed the international political situation which led to the present shortage of nickel, and the substitutes or alternates which had been proposed. He then centered his attention on the copper-chromium-enamel cycle which has been widely adopted, pointing out that the successful plating of chromium over copper requires the use of low bath concentrations and low bath temperatures. It is also advisable to have the current on or apply it very soon after the work enters the bath to avoid attack on the copper by the chromium solution. To secure good adhesion of clear enamel, the chromium plate should best be treated in a phosphate-type alkali cleaner, followed by a dilute rinse containing 1-2 oz chromic acid per 100 gal of water.

A buffet lunch followed the meeting.

C. SCHREUR, *Publicity Manager*

HAMILTON BRANCH

The guest speaker on November 15 was MR. W. J. ANDERSON, of the J. W. Westaway Company, Hamilton, who spoke on de-ionizing of water.

The speaker explained, with the aid of chemical equations, how the resins through which the water is forced attract the impurities in the solution, and demonstrated how, by utilizing this ion-exchange principle, water free from all impurities is produced.

When the meeting was opened for discussion, the subject of disposal of plating-room wastes was broached. The interest in this subject is indicated by the fact that the discussion lasted 1½ hours.

The Branch will henceforth meet on the third Thursday of each month instead of on Friday.

JOHN HARDEN, *Correspondent*

HARTFORD BRANCH

The meeting on November 19 was attended by 75 members and guests. Preceding the meeting an A. G. Spalding film in color, entitled "Famous Fairways", was shown. MR. GEORGE HOGABOOM then gave a report on "Latest Developments in the Finishing Industry".

The speaker for the evening was MR. RALPH MCCAHAN, of the E. I. duPont de Nemours & Company, whose subject was "A Report on White Brass". Due to the scarcity of nickel, white brass is used in many cases to replace copper and nickel undercoatings for chromium. The bath was suggested by F. F. Opinger: 2 oz/gal of copper cyanide and 8 oz/gal each of zinc cyanide, sodium cyanide and sodium hydroxide, together with such brighteners as Zinodyte and sodium molybdate. Alloy anodes of 80 per cent zinc and 20 per cent copper are used, and for bright deposits a current density of 20 asf is employed, at room temperature, preferably with agitation. The bath is purified by electrolysis. In barrels, it plates faster and brighter than nickel.

White brass is good for inside exposure, as on light fixtures, tools, screws, etc., and for outside exposure with chromium over it. The deposit looks like nickel, and is easily buffed. Its brittleness and high internal stress may cause difficulty on large parts; copper flashing before white-brass plating helps to overcome it.

The Technical chairman for the evening was KENNETH KELLY, and refreshments were served through the courtesy of the duPont Company.

STANLEY PLATOZ, *Secretary*

INDIANAPOLIS BRANCH

Because of the inclement weather only 28 members were present at the meeting on November 7. There were 3 visitors from the British Isles: MESSRS. W. LORD, G. BELSEY, and H. CHRISTMAS. They were in Indianapolis visiting the local plant of R. C. A. in the interest of The Gramophone Company.

One new member was elected. The Branch changed its fiscal year to coincide with the calendar year.

The speaker of the evening was one of our own members, DR. A. M. MAX, Supervising Engineer of the Record Laboratory of the local R. C. A. plant. Dr. Max's subject, "Iron Plating", was one of which we have little knowledge. He reviewed its history, beginning with its use for electrotypes for printing Russian bank notes in 1868. The solution is now being used in place of chromium to build up worn parts, as replacement for copper in electrotypes, and in other electroforming applications. Most iron plating is done by the Bureau of Engraving and Printing, Washington, D. C.

Formulas for both the sulfate and the chloride baths were given and the troubles encountered, mostly pitting and roughness, were explained.

EDWARD BRUCK, *Secretary*

JACKSON-LANSING BRANCH

The Branch held its November meeting on the 13th. After the forty members had finished an excellent roast beef dinner, PRESIDENT WILLIAM MOGLE conducted a short business session. The proposed mid-year meeting of the Branch delegates was discussed. A letter from the Los Angeles Branch advocating the selection of MR. R. S. WOOLEY for A. E. S. Vice-President was read.

The featured speaker was MR. HOWARD J. MCALEER, President of Formax Manufacturing Corporation. He gave a very informative talk on the polishing and buffing tools used in finishing for defense. A copy of his recent article, "Polish Up Your Buffing Data", was presented to each member. A discussion followed, after which a vote of thanks was given to Mr.

McAleer for providing both the tasty meal and real money-saving ideas on how to finish some war items.

The meeting closed with one of Larry Hesterberg's educational gems, a movie entitled "Research Pattern for Progress".

J. H. Hoffer, *Correspondent*

LANCASTER BRANCH

The meeting on November 9 was held in the Old Mill Inn, Lincoln Highway West, Lancaster. Thirty-five members and guests attended.

Three new members were elected. The History Committee reported that the history of the Branch would be completed in the near future.

Librarian Marian Myers introduced the speaker, Dr. Walter R. Meyer, President of Enthone, Inc. After having described, briefly, the plating procedures he had seen in Brazil, he discussed the acid treatment of metals. For aluminum, hydrofluoric acid is 10-20 times faster than hydrochloric, phosphoric or sulfuric acid. For pickling copper or brass, sulfuric gives the best results; although, in some cases, phosphoric or sulfamic acid is used. A mixture of sulfuric, nitric and hydrochloric acids is used for pickling such tin alloys as bronze. When lead is used as an alloying element, a good pickle is either fluoboric or sulfamic acid. Chromic acid is employed on cadmium and zinc.

Bright dipping tends to produce a mirror-like reflection from an uneven surface. For the most satisfactory results, the bright dip has to work fast. Some important facts to bear in mind are: Even though hydrofluoric acid is a weak acid, it requires careful handling; the heating of hydrochloric acid is rather difficult, although, there are avilable at the present time pyrex coils as well as graphitic-carbon heaters; nitric acid is not used to a great extent because it causes oxidation; acetic acid in some mixtures with other acids seems to serve as a wetting agent.

After Dr. Meyer had answered a number of questions, everyone enjoyed a Dutch lunch.

Harry A. Saylor, *Secretary-Treasurer*

LOS ANGELES BRANCH

The November meeting was addressed by Mr. Clyde Kelly, who is as versatile as a four-way cold tablet, as (1) Chairman of the Chicago Industrial Finishing Exposition, (2) General Chairman of the Chicago Convention, (3) Chairman of the Research Finance Committee, and (4) speaker of the evening, representing B. Mercil & Sons Plating Co. of Chicago.

He did a good job in all departments, telling us that the Convention and the Exposition were going to be very much worthwhile, and, very explicitly, why more money was needed for research. He then discussed the zinc-barrel plating methods used by Mercil, which is probably the largest barrel-plating job shop in the world.

The standard solution described in literature is used with suitable commercial addition agents to provide necessary brightness. Plating barrel materials are of hard rubber, Plexiglas, Melamine or Lucite. A variable-speed drive is employed, ranging from 2 to 10 rpm, to handle different types of work. Koroseal-lined tanks are used to a large extent. To aid cooling, large volumes of solutions are used, e. g., 1150 gal of solution in a four-barrel zinc unit. In a 14 x 36-inch barrel the load is kept at 0.3 cu ft, or 135 sq ft, or 125 lb. Continuous filtration has been proved to pay off.

With tap water at 65° F, 1 gal of water per hour per ampere is required to maintain the solution at suitable working temperature during the summer. Phesoll Manufacturing Company employs a 10-ton refrigerating system to cool its zinc-barrel solutions: it is more economical than using ice, inasmuch as a 6-barrel unit, with one barrel replaced by an iron box, used 1½ tons of ice per day to maintain the temperature.

Most cleaning is carried out in monel cylinders or in suitable plating barrels. Alkali cleaning without vapor degreasing is usually satisfactory. When pickling is difficult, sulfuric acid at 120° F or hot concentrated muriatic acid is used.

An incentive system and group piece work have raised production. Under existing conditions, the total time is 0.4 hour per load. A discussion followed Mr. Kelly's presentation.

Other out-of-town guests were Messrs. E. E. Huenerfauth, of Crown Rheostat & Supply Company, Chicago; C. E. Smith of Mercil Plating Equipment Company, Chicago, and John Seifen of the J. J. Seifen Company, Detroit.

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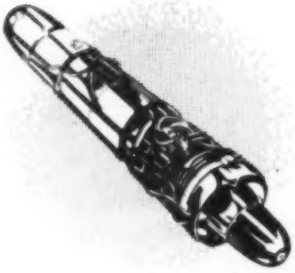

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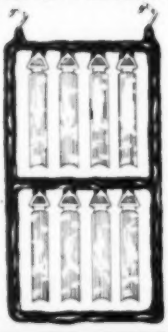

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How to Determine Impurities in Copper Plating Baths

SILVER in copper plating baths may be determined colorimetrically, by using a carbon tetrachloride solution of dithizone to produce the colored solution. The hue measured is that of the mixed color of silver keto dithizonate and cupric keto dithizonate. Small amounts of certain other metals do not interfere, nor is separation of the silver required.

CHLORIDE, also, may be determined colorimetrically. The method depends upon the addition of a known quantity of silver ions and determining the excess of silver ions remaining after silver chloride has been precipitated. The excess is determined by the mixed color of silver and cupric dithizonate.

LEAD traces are determined as follows: Organic material is oxidized with phosphoric acid and the lead is separated from interfering ions by extracting with a carbon tetrachloride solution of dithizone in the presence of potassium cyanide. Transmittance of the solution is measured and the quantity of lead determined from a calibration curve.

CHROMIUM: To determine chromate chromium, nitric acid is added to oxidize any reducing agents, phosphoric acid is added to make a complex with Fe^{+++}, and diphenylcarbazide is added to form a colored complex. Transmittancy of the solution is measured, and the amount of CrO_3 present as chromate is read off the calibration curve.

For total chromium analysis, iron is first removed by precipitation. The chromium is oxidized first by fuming with perchloric acid and then by boiling with ammonium persulfate in the presence of silver ions. The silver is precipitated. The solution is centrifuged, the transmittancy of the clear supernatant solution measured, and the amount of CrO_3 present is determined from the calibration curve.

NICKEL can be accurately determined colorimetrically by forming nickel dimethylglyoxime but copper must first be removed quantitatively.

A.E.S. RESEARCH PROGRAM

The American Electroplaters' Society is conducting a comprehensive research program and has developed useful information on current plating problems. International Nickel, in addition to its other support of this program, feels that it will be a further service to make copies of these A.E.S. Research Reports available.

For an authoritative, detailed, 54-page study of this subject, we offer you a free copy of the A.E.S. Research Report, Serial No. 16, entitled "Determination of Impurities in Electroplating Solutions." Use coupon now.

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EMBLEM OF INCO SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

Branch News

Earl Coffin reported the recent death, in a traffic accident, of one of our valued members, Joseph Sunderhaus. Paul Franke, who was recently burned quite seriously in an accident in his plant, was up and about.

The meeting was attended by over 75 members and guests.

G. S. Krentel, *Secretary*

MELBOURNE BRANCH

Forty-three members and visitors attended the 67th Regular Meeting of the Branch on November 15, when President Bob Taylor welcomed 11 new members, whose election puts the Branch over the 150 mark.

Librarian Hugh Teague introduced the speaker, Mr. Bruce Johnston, whose subject was "Effects of Impurities in Plating Solutions as Shown by the Hull Cell Test". The speaker stressed the importance of cathode preparation and of using the same cathode material in comparative runs.

The main uses of Hull Cell are: (1) in the determination of results of solution treatment, in which small aliquots are treated experimentally and tested in the cell before the bulk of the solution is treated; in addition, the current density range can very easily be determined; (2) in the development of new solutions, e. g., the effects of addition agents on the bright plate range of a cadmium solution were demonstrated; and (3) in the detection and identification of impurities. Samples showing the effects of various impurities were exhibited. In a demonstration, plates were made first from a pure nickel solution and later after the same solution had been deliberately contaminated. The speaker then showed how to purify the solution, and checked that impurities had been removed.

Rowland H. Keller,
Honorary Secretary

MILWAUKEE BRANCH

For the 18th consecutive year Milwaukee Branch was honored by the presence of Mr. Walter Pinner at a dinner, held at the North Hills Country Club on November 2. This annual visit has become a tradition, and the meeting serves both as an educational and as a social event. Glen Schwemmer, assisted by Gene Rost, Bill Reibberg and others, had arranged a splendid dinner and a variety show calculated to please everyone of the 150 members and guests present.

Mr. Pinner's lecture touched on many problems facing the electroplating industry today. He discussed the efforts made by his organization, the Houdaille-Hershey Corporation, to meet the changing situation. Of prime importance is that we maintain the highest quality of finish commensurate with available materials and skill and knowledge to apply them; the industry may otherwise receive a setback from which it will take a long time to recover. Every means should be used to inform the consumer that he should take measures to safeguard the appearance of plated parts. Some manufacturers already indicate on their merchandise the need to apply wax or grease films at stated intervals in order that the emergency electrodeposits perform satisfactorily.

As material restrictions came along, the several acid copper and cyanide copper processes took on new importance. It was of interest to note the difference in leveling characteristics of each. Leveling is an important factor in the reduction of polishing and buffing costs but requires attention to detail, such as the use of recommended equipment and solution treatment.

Mr. Pinner touched on the status of the salt-spray test and the necessity for improving it to get better correlation between test and field results. Every effort is being expended to find a more satisfactory approach to this old problem.

Mr. Pinner made no predictions for the future. His outline of what is being done and what can be done, however, encouraged the audience. Many questions were asked throughout the evening by the largest crowd of the year. All came out to learn something, and the consensus is that they learned much.

Judge William O'Neil of the Milwaukee Court delivered the coffee talk. He spoke of this, our country; of its institutions and what made them great; of the need for a greater interest on the part of each one of us in order that the things we treasure shall remain ours and shall pass on to other generations. Judge O'Neil received a standing ovation as he concluded.

Thanks for a successful event go to Walter, Judge O'Neil and the following friends of the Branch without whose financial support the meeting could not have been held: Topp Oil and Chemical Company, Ankor Plating Rack Company, George A. Stutz Company, Redi-Products Company, O'Donahue Sales Company, Davis Coating Company, and Hanson-Van Winkle-Munning Company.

Vincent Mattacotti,
Correspondent

NEWARK BRANCH

Fifty-two members and guests attended the regular monthly meeting on October 19.

A resolution in the memory of John L. DeVries and a letter to Mrs. De Vries was read by President Frank England and approved by the members.

Five new membership applications were received. The President appointed George Wagner chairman of the annual Christmas Party and George Reuter to fill a vacancy on the Board of Managers.

Thomas Austin presented the guest speaker, Mr. Clifford Strutck, of the General Chemicals Division, Allied Chemical & Dye Corporation, who gave a very appropriate talk about "Fluoborate Plating Solutions". He dealt with fluoborate tin, lead-tin, zinc-tin, cadmium tin and nickel baths, and illustrated the different deposits by means of slides. Numerous questions from the floor were answered.

George Wagner, *Secretary*

NEW YORK BRANCH

At the meeting on November 9, there were 5 new applications for membership, and 4 applicants were elected.

A communication from the San Francisco Branch advocating that Mr. Wooley be elected Third Vice-President at the Annual Meeting in Chicago was filed away under "Unfinished Business".

After a discussion, the Branch went on record as opposing any type of endorsing of any commercial enterprises by the American Electroplaters' Society.

A suggestion for amending the by-laws of the New York Branch, presented by the Board of Managers, was voted down.

Following the business meeting, a film entitled "The Air We Breathe" was shown.

Peter L. Veit,
Recording Secretary

PHILADELPHIA BRANCH

The October meeting was held at the Fernstedt Division, General Motors Corporation, plant in Trenton, N. J., on Friday the 26th. A delicious dinner was served to 131 members and guests by the Division. In all, 155 attended the meeting, a banner turnout.

Charles Wilson, a Philadelphia Branch member, who represented the Company in arranging the meeting, introduced Mr. William Bennett, Plant Superintendent. He welcomed the members and guests, and described briefly the size and scope of the operation. He also paid tribute to the A. E. S. for the role played in the development and improvement of plating during the past 40 years.

Branch President Al Pope opened the meeting and expressed to the Division the appreciation of the Branch for its graciousness and generosity.

Mr. C. F. Nixon, A. E. S. President, spoke a few words about Supreme Society activities, and announced the Delegates meeting in Philadelphia on February 9. He was followed by A. E. S. First Vice-President Franklyn MacStoker, who spoke briefly of Executive Board activities. Dr. D. Gardner Foulke, of the Executive Secretary's office, was also introduced.

The Secretary read 6 new applications for membership. Librarian Clarence E. Boerckel introduced the principal speaker, Dr. J. W. Cuthbertson, Assistant Director of Research of the British Tin Research Institute, whose topic was "Electrodeposition of Tin-Nickel Alloy

Plate". The research started with the still unsolved problem of adding small amounts of nickel to increase the hardness of tin. Tin-nickel is now plated in atomic proportions (SnNi). The problems involved in regulating the proportions of tin-nickel in deposits from simple acid baths were explained, and the effects of various complex salts on cathode efficiency were shown. The bath composition finally used was stannous chloride, 50 g/l; sodium fluoride, 58 g/l; ammonium bifluoride, 35 g/l; and nickel chloride 300 g/l. The optimum current density is 24 asf; temperature, 65° C. No addition agents tried would benefit the bath operation; all suppressed completely the deposition of tin.

Slides showed the effects of composition variables on the deposit. The brightness is a function of the fluoride concentration, an increase giving the brighter deposits; but the tin content decreases with an increase in fluoride concentration. The conductivity is slightly higher than that of a straight nickel chloride bath, and the throwing power is excellent at all current densities. Separate tin and nickel anodes are used on same circuit at 100 per cent efficiency. Owing to the tendency of tin anodes to sludge, they should be withdrawn from an idle bath; bagging helps to prevent roughness. Inasmuch as the bath is corrosive, corrosion-resisting linings should be used; Lucite, Neoprene, and rubber (free from excess sulfur and with minimum filler content) are satisfactory. Pitting is common, but is overcome by frequent bath contact with activated carbon.

The deposit is resistant to corrosion and tarnishing, with no visible effect after two years of outdoor exposure. A deposit thickness of 0.0005 inch is adequate on copper and copper alloys. Although required adequate thickness is not yet known, 0.0003 inch copper and 0.0005 inch tin-nickel are now being applied over steel.

Two pilot plants in England are being watched for economic advantages. The process is patented in England, and patent is applied for in the United States. Permission to use may be obtained from the Tin Research Institute.

Following Dr. Cuthbertson's talk the following questions were submitted: *Q.* What is effect of boric acid? *A.* Not tried yet.—*Q.* What is the leveling effect? *A.* Slight; brightness depends on brightness of base metal; a 0.014 inch deposit was very smooth but not bright.—*Q.* What is the solderability with soft solder? *A.* Very good.

Following the meeting, a conducted tour was made of the enormous Trenton Plant, with special attention being given to its huge automatic plating and polishing facilities.

I. Wm. Marcovitch, *Secretary*

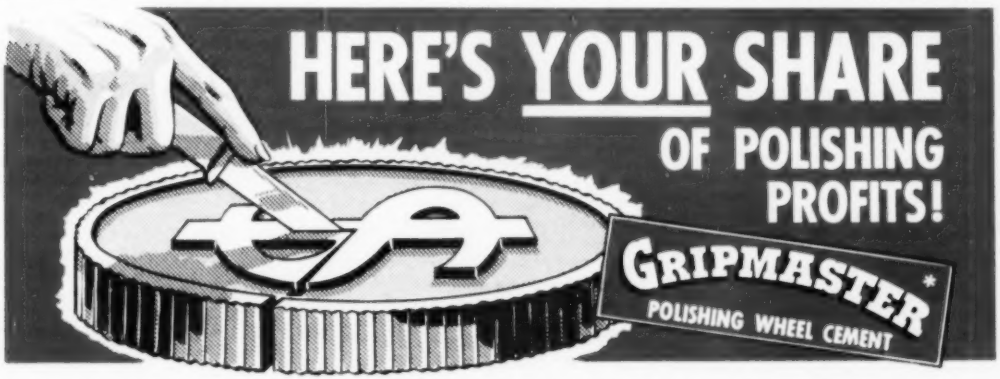
PHILADELPHIA BRANCH

The Annual Educational Session and Banquet was held in the Broadwood Hotel on November 17.

The attendance at the afternoon Educational Session, chairmanned by Clarence E. Boerckel, was about 75. The first speaker was Dr. William Blum, retiring Chief of the Electrodeposition Section of the National Bureau of Standards. His "Summary of Electrodeposition Researches at the National Bureau of Standards" will be printed in the 1951 Proceedings.

Mr. Gordon Eustin, Bureau of Aeronautics, Navy Department, Washington, D. C., then spoke about "Plating and Surface Treatment of Naval Aircraft". The following types of corrosion hazards are encountered: (1) Climatic, e. g., heat and humidity in the tropics; (2) operational, e. g., ocean spray, ships' stack gases; (3) operating materials, e. g., combustion gases from the aircraft itself, galvanic action; (4) construction factors, e. g., heat treatment, action of heat-treatment salts.

Following a discussion of cleaning and pickling requirements for basis metals, Mr. Eustin dealt with specific application of some coatings, including (1) preference for the channel-type porous chromium to the pin-point type for reasons of lower wear and oil consumption; (2) the use of nickel plate for corrosion resistance, especially, at high temperature;



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(3) the use of tin, lead, indium, cadmium-indium and copper for antigalling purposes; (4) the use of tin-cadmium alloy (plated separately and then diffused by baking) for corrosion resistance inside engines; (5) a comparison between conversion coatings, anodized coatings, the chromic acid wash and the alcohol-phosphoric acid wash on aluminum; (6) the use of the HAE treatment for magnesium for extraordinary corrosion resistance (disadvantages are spalling on bending and reduction of fatigue resistance of magnesium).

Whereas most specifications require a salt-spray test, this test is gradually being replaced, *e. g.*, by coating-weight requirements for anodized coatings (200 mg/sq ft for chromic acid-, 1200 mg/sq ft for sulfuric acid type coatings).

Mr. C. F. Nixon, Director of Process Development of the Ternstedt Division, General Motors Corporation and A. E. S. President, was the last speaker. His paper on "Decorative Chromium Plating without Nickel" was a progress report dealing with the following cycles: (1) high copper, low nickel, chromium, lacquer; (2) copper, chromium, lacquer for outside use only; (3) zinc, chromate bright dip, lacquer; (4) copper flash, white brass, chromium, lacquer for outside use only. With no reliable tests for the evaluation of the coatings (the salt-spray test is unsatisfactory, and even outdoor exposure tests do not give the final answer) one has to rely on educated guessing.

In cycle 1, 0.0003–0.0005-inch nickel and a total of 0.0015 inch are used outdoors; the nickel thickness indoors is 0.0002–0.0003 inch. The nickel coatings are applied at the usual high current density, but for shorter time than before. Auto owners should wax or oil the coatings. With nickel eliminated in the cycle 2, there is less leveling, and the steel must be buffed better. Cycle 3 is used extensively on both zinc-base diecastings and steel, but the color differs from that of chromium. The white-brass deposits (0.0002–0.0003 inch) of cycle 4 contains 5–20 per cent copper and can be readily chromium plated. The bath, based on Opplinger's work, has leveling properties, and requires brighteners for brightness. Work is in progress to eliminate the hair-line cracking which develops when subsequent lacquer is baked.

The evening was devoted to the banquet, entertainment and dancing, enjoyed by 294 members and guests. The Branch gratefully acknowledges the work done by the several committees and the financial support of those who advertised in the program.

I. Wm. Margovitch, *Secretary*

PITTSBURGH BRANCH

Twenty-five members enjoyed a delicious steak dinner prior to the meeting on November 8.

After President Bob Woofter had welcomed and introduced a number of the guests present, Dr. F. A. Lowenheim, of the Metal and Thermit Corporation, delivered a very interesting and timely discussion on "Tin-Zinc Plating". Although still new, plating of this alloy is definitely out of the laboratory stage, with many installations being operated successfully and an upsurge in new installations expected in the immediate future. Tin-zinc has many of the desirable properties of cadmium and zinc deposits, and a cost between the two. A lively and informative question and answer period followed the lecture.

Refreshments were served, and everyone agreed that the meeting had been successful from both an educational and a social standpoint.

R. H. Schindler, *Secretary*

PROVIDENCE-ATTLEBORO BRANCH

The first meeting of the season was held on October 15 in the Providence Engineering Building on Angell Street. Mr. George Frankowich, Executive Secretary of the New England Manufacturing Jewelers and Silversmiths, discussed "The Future of Metals in Jewelry Manufacture". As would be expected, the outlook is bad. However, it is hoped to maintain the jewelry industry for the next year as follows: 30 per cent on copper and brass, 30–40 per cent on lead and zinc, and the balance of the production in plastics, aluminum, steel and silver.

It is desired to keep this industry going, as it is the second largest industry in Rhode Island. The Providence-Attleboro area, with its 30,000–40,000 workers, produces the major portion of the jewelry manufactured in the United States. The retail value of the industry is one and one-quarter billion dollars. If this group of highly specialized workers be not kept intact, it will not be available when defense production gets rolling on high-precision small parts, which must be farmed out in many sub-contracts. During World War II, this group was engaged to 70 per cent of total capacity in war work.

Edward A. Parker, *Secretary*

ROCHESTER BRANCH

The first meeting of 1951–1952 season was called to order by Branch President Ray Bergfold at 9:10 P. M. on September 17.

Applications from three individuals were accepted and approved by the members.

Joe Hull gave summary of the proceedings at the Buffalo Convention, after which the meeting was taken over by a Board of Experts, which included S. P. Gartland (A. E. S. Honorary Member), J. Lenzi, Joe Hull, and J. O. Adams.

After an interesting and fact-filled discussion, the meeting was adjourned for light refreshments.

Charles B. Fideor, *Secretary*

ROCHESTER BRANCH

The October meeting was called to order at 8:15. Two membership applications were approved.

Mr. Clifford Struyck, of General Chemical Division, Allied Chemical & Dye Corporation, was the guest speaker. His talk on "Fluoborate Plating Processes", in which he covered the deposition of common metals from fluoborate solutions, was very well received.

Refreshments were served after the meeting.

Charles B. Fideor, *Secretary*

ROCKFORD BRANCH

Our speaker on November 12 was Mr. Leo Hoellen, of duPont's Finishes Division. Mr. Hoellen's subject, "Testing of Organic Finishes", was concerned mostly with the white enamels used on refrigerators, their properties and methods of tests. He explained the correlation of field trials, laboratory tests and actual results. The long discussion period that followed dealt with surface preparations of metals before the application of the organic coatings.

Mr. Hoellen then showed two colored movies, one about the manufacture of fabrics and the other about how a research project was started, developed, and eventually placed in industry. Both the lecture and movies were very interesting and enjoyed by all.

Attendance was 30 at the dinner, and

42 at the lecture. Two active members were admitted to the Branch.

KENNETH KIESELBURG,
Secretary-Treasurer

SAGINAW VALLEY BRANCH

Thirty-six members and guests attended the regular monthly meeting on November 14 in Zehnders Hotel, Frankenmuth, Mich.

The meeting was opened by PRESIDENT WARNER REMINGTON. The guest speaker was MR. HOWARD MACALEER, of the Formax Company, Detroit, Mich. He gave a very interesting talk on gadgets used in the burring, polishing, and buffing of small parts and in hard-to-get-at-places. He also discussed buffing compounds.

The door prize, furnished by the Northwest Chemical Company, Detroit, Mich., was won by G. W. CLINE of Buick Motor.

Four gentlemen were elected to membership

A movie was shown by WILLIAM SNYDER, Buick Motor, following the dinner.

ELDON A. BRUSSON,
Recording Secretary

ST. JOSEPH VALLEY BRANCH

Despite the 10-inch snowfall on November 7, 14 members attended the dinner and 15 the technical session.

Two men were elected to active membership, and there was one new application for membership.

The speaker, MR. L. E. WYBEL, of U. S. Stoneware Company, dealt with "Corrosion Resistant Materials", especially for the protection of floors, ducts, hoods, structural steel, and tanks. Each layer of the floor—the base concrete, the membrane, the brick and the cement—must be of the correct material and must be installed properly. Types of materials were discussed, including their advantages and disadvantages. Acid- and leak-proof floor coatings must be tough, dense and must bond very well. Hydrocarbon-membrane compounds and sheet, red-shade and buff brick, and their absorption factors were discussed. For air ducts, hoods and structural steels, vinyls seem to do a good job. The steel must be absolutely clean before the primer and paint is applied. The suggestion was made to use different colors for the different coats, so that one can tell just how many coats were applied. Primerless coats do not hold up too well under acid conditions.

For tanks, the vinyls, including sheet compound, are the most versatile. Tanks can be lined with sheets right on the job, without high-temperature curing, and the sheets will hold up well in solutions of nickel, chromium, cadmium, zinc, copper, etc. After the talk, Mr. Wybel answered many questions from the floor.

EUGENE ROTH, *Secretary-Treasurer*

ST. LOUIS BRANCH

The Branch was honored by the presence of DR. A. KENNETH GRAHAM at its November meeting.

Thirty enjoyed the dinner, and 40 were on hand for the educational session.

After O. DINGELDEIN had spoken about working with other Branches, a Spring Dinner-Dance and Educational Session was discussed. There will be a meeting of all officers. Delegates and board members before our next meeting to discuss the dance and the changing of the election of officers to an earlier date.

LIBRARIAN WEISBERG introduced Dr. Graham, who spoke about "Disposal of Plating Room Wastes from an Electroplater's Viewpoint".

ED HUNLETH, *Secretary*

SAN FRANCISCO BRANCH

The meeting on October 13, at the Colonial Manor, San Francisco, was the second Quarterly Educational Session, with cocktails and entertainment provided prior to meeting by suppliers of plating and polishing equipment.

After J. R. PATTENGER had eulogized our deceased member, LOUIS DELAMOTHE, PRESIDENT GEORGE H. COOK called for a minute of silence in his memory. MR. ALEXANDER was appointed to write an obituary for publication in PLATING.

VICE-PRESIDENT STUART W. PANKEY gave an educational-session lecture on the subject, "Stripping and Cleaning of Prior Coatings before Refinishing". Members desiring a copy of this lecture are invited to make a request for same.

There were 27 members and 4 visitors in attendance.

HORACE J. SMITH, *Secretary-Treasurer*

SYDNEY BRANCH

The meeting on November 8 was the 78th regular meeting and the annual meeting of the Branch.

MR. E. J. WRIGHT, of Australian General Electric, gave an interesting talk on "Bi-Polar Effects in Plating Tanks", confining his lecture to a description of instances encountered by himself and others in his plant. He succeeded in bringing home the importance of these effects in everyday plating.

The following members were elected to office: *President*, J. F. MURPHY; *First Vice-President*, F. R. BELLENGER; *Second Vice-President*, B. W. ARMSTRONG; *Secretary-Treasurer*, B. BRIDGEMENT; *Board of Managers*, E. J. WRIGHT, W. H. MILLWARD, J. H. LEAN.

No librarian was elected, as it was decided that the seven officers would act as educational board.

W. W. PATERSON, *Secretary-Treasurer*

SYRACUSE BRANCH

The November dinner meeting was held at the Moose Hall with 32 members and guests attending.

MR. W. M. TUCKER, former chairman

(*Continued on page 97*)

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Membership Report of the A. E. S.

Elections

BUFFALO: R. F. Hofman, B. C. O'Keefe, P. W. Talmon

CHICAGO: J. E. Ahearn, A. O. Bruder, E. I. Harrison, F. M. Hubrich, W. O. Preble, O. Quist, T. Reinewald, C. J. Saporito, M. A. Saporito, J. N. Williams

CLEVELAND: B. C. Avellone, C. F. Brooker, Jr., M. Eden, V. P. Nastoff, J. C. Schaefer

DETROIT: G. W. Drysdale, H. W. Heilman, E. H. Shotwell, W. J. Weisenburg

HARTFORD: J. L. Leahy, J. G. Moratti, J. J. O'Leary, J. R. St. Pierre

INDIANAPOLIS: J. A. Gutman

JACKSON-LANSING: L. Bamm, P. Bowser, E. C. Mattson, V. F. Scott

LANCASTER: G. Skelly, G. S. Wells, G. L. Wilt

LOS ANGELES: R. E. Alexander, W. R. Hoyt

MELBOURNE: J. Blake, A. B. Durnford, B. Fennessy, A. E. Fergie, J. Johnstone, F. J. King, F. J. McKinley, B. Morley, B. Smith, A. Storey, A. Sungaila

NEW HAVEN: J. J. Gido, C. A. Kuster

NEW YORK: B. B. Joffe, S. M. Karten, M. Reich, H. K. Tourtmas

PHILADELPHIA: J. R. Albert, E. S. Jones, F. C. Lindsay, C. A. Rauschert, J. F. Washko

PROVIDENCE-ATTLEBORO: A. M. Weisberg

ROCHESTER: E. Fasano, M. J. Fasano, M. G. McCormick, M. Ottenschot, D. Philips, R. C. Valente, C. F. Van Epps

ROCKFORD: C. Carlson, S. H. Linden

ST. JOSEPH VALLEY: C. L. Crowell, C. Stockman

SAGINAW VALLEY: L. A. Becker, J. T. Parrish, G. L. Zimmerman

SYRACUSE: A. F. Botoli

WATERBURY: W. R. Kennuess, Jr.

WESTERN ONTARIO: E. L. Patterson

MEMBER-AT-LARGE: M. E. Blumberg

Reinstatements

CHICAGO: J. Bryden, C. A. Oswald

CLEVELAND: P. Ross Lyons

DETROIT: E. V. Connell

PHILADELPHIA: V. A. Bradd,* H. H. McIntyre

PITTSBURGH: P. B. McCloskey

ST. JOSEPH VALLEY: O. Fager, D. Pocock, H. Sherk

SYRACUSE: W. A. Cary

MEMBER-AT-LARGE: V. M. Grau

Membership Competition

BRANCH	Membership Apr. 1, 1951*	New Members	Net Change in Membership	Per Cent Net Change
First Group				
Melbourne	126	36	+30	+23.8
Chicago	409	42	+38½	+ 9.4
New York	279	21	+22	+ 7.5
Hartford	137	9	+ 6	+ 4.4
Boston	151	7	+ 6	+ 4.0
Waterbury	126	4	+ 2	+ 1.6
Cleveland	205	19	+ 2½	+ 1.2
Bridgeport	152	9	+ 1½	+ 1.0
Milwaukee	143	9	.....	.....
Detroit	492	28	− 9½	− 1.9
Newark	239	8	− 5	− 2.1
Los Angeles	211	11	− 8	− 3.8
Philadelphia	201	11	− 8	− 4.0
Grand Rapids†	164	1	−11½	− 7.0
Pittsburgh	132	5	−10	− 7.6
Second Group				
Rockford	97	10	+10½	+15.7
Buffalo	85	14	+13	+15.3
Indianapolis	92	8	+10	+10.9
Toronto	121	9	+ 8	+ 6.6
Syracuse	85	10	+ 4	+ 4.7
Rochester	88	9	+ 2½	+ 2.8
Baltimore-Washington	87	5	+ 2	+ 2.3
Dayton	82	2	.....	.....
Providence-Attleboro	100	1	− ½	− 0.5
Cincinnati	88	4	− ½	− 0.6
St. Louis	105	3	− 3	− 2.9
St. Joseph Valley	71	3	− 3½	− 4.9
Sydney	93	3	− 6	− 6.5
Montreal‡	77	4	− 8	−10.4
New Haven	108	3	−19	−17.6
Third Group				
Dallas-Fort Worth	31	14	+13½	+43.5
Houston	25	8	+ 9	+36.0
Saginaw Valley	57	15	+ 8½	+14.9
Jackson-Lansing	52	5	+ 3½	+ 6.7
Lancaster	60	5	+ 4	+ 6.7
Louisville	23	1	+ 1	+ 4.4
San Francisco	65	5	+ 1	+ 1.5
Hamilton	25	.....	.....	.....
Allentown-Reading‡	42	2	− ½	− 1.2
Twin City	66	1	− 2½	− 3.8
Southeastern	48	3	− 3	− 6.2
Toledo	45	.....	− 4	− 8.9
Adelaide	65	5	− 7	−10.8
Columbus	54	2	− 7	−13.0
Springfield	54	2	− 7	−13.0
Western Ontario	23	5	− 5	−21.7
Outside Competition				
At Large	120	12	− 6	
In Transfer	16	.....	+10	
Total A. E. S.	5,387	401	+72	+ 1.3

Active Membership, December 1, 1951 5,459

*Subject to correction. †, ‡, §Winners in first, second and third group, respectively, of 1950-1951 membership competition.

Transfers

L. J. Howald from Cleveland; K. F. Greene from Detroit to Cleveland; E. J. Quinlan to Detroit; B. C. Case from Detroit; J. Miller to Detroit; H. M. Moran from New Haven to Waterbury; B. B. Joffe from New York to Buffalo; I. H. Schram, Jr., from Membership-at-Large to Pittsburgh; G. A. Gibbs to Providence-Attleboro; F. C. Mesle from Rochester; W. A. Hopkins from Saginaw Valley; E. B. Hunt to Saginaw Valley

Resignations

PROVIDENCE-ATTLEBORO: R. W. Cummings

ROCHESTER: G. W. MacDonald, A. Thurber

Suspensions

MONTREAL: H. F. Beaupre, J. D. Camirand, E. Desbiens, W. S. Hogg, E. Kenalty, C. E. Shutt, J. A. Thomas

ROCHESTER: R. L. Bolinas, E. O. Olds, E. Reip, L. Treman

SPRINGFIELD: E. Avault, A. A. Copp, F. Rickus, G. B. Sampson, J. Weir

Deaths

LOS ANGELES, J. Sunderhaus

SYRACUSE: O. LaBreeque

MEMBER-AT-LARGE: G. G. Southall

Branch News

(*Continued from page 95*)

of the A. E. S. Research Committee, was the speaker of the evening, and gave a detailed report of each project. Its progress was explained in detail, along with the Committee's problems. A question-and-answer period followed. We could use more fine talks like this one.

Ted Dailey, Syracuse University's line coach, provided the commentary to movies of his team in action.

Refreshments were served through the courtesy of Oakite Products, Inc., with Dave Clarin and Bob Colvin as hosts.

Lindley S. Wood, *Secretary*

WATERBURY BRANCH

At the regular meeting on October 12, Mr. W. M. Phillips, of General Motors Research Laboratories, presented a stimulating talk entitled, "Where Do We Go from Here". He discussed ways and means of providing durable plated finishes in spite of the shortages of metal supplies.

The film, "Letter to a Rebel", depicting the American way of life, was shown. This film is one of the finest mediums for combating subversive propaganda.

President Earl Couch appointed a committee to canvass prospective sustaining members, and urged those present to promote the interest of organizations that are potential sustaining members.

C. W. Maxwell, *Public Relations*

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40 Thames Street, New York 6, N. Y.

Secretary ..... The Executive Secretary

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Address G.P.O. Box 598E, Adelaide, S. A., Australia.

ALLENTOWN-READING meets third Wednesday of each month in Spurgeon's Hotel, Allentown, Pa. Secretary-Treasurer, Mrs. Pearl T. Treichach, 610 Allen Street, Allentown, Pa. Research Finance Committee Chairman, William R. Pfeiffer, Jr., 975 Green Street, Allentown, Pa.

BALTIMORE-WASHINGTON meets second Tuesday of each month with meetings in Baltimore at the Engineers' Club and in Washington, D. C., at the National Bureau of Standards. Secretary, Vincent J. Hughes, Jr., Hughes Chemical Supply Company, 1411 Fleet Street, Baltimore 31, Md.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown 72, Mass. Research Finance Committee Chairman, Eugene P. Carter, c/o United Carr Fastener Corporation, 31 Ames Street, Cambridge, Mass.

BRIDGEPORT meets second Friday of each month in Barnum Hotel. Secretary-Treasurer, Gerald B. Rice, 367 Grandfield Avenue, Bridgeport 8, Conn. Research Finance Committee Chairman, Carl Schaefer, c/o Casco Products Corporation, 512 Hancock Avenue, Bridgeport 5, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary and Research Finance Committee Chairman, B. P. Fortin, Jr., 209 Forest Drive, Orchard Park, N. Y.

CHICAGO meets second Friday of each month at 8 P. M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-Treasurer, Paul Glab, 882 N. Paulina Street, Chicago, Ill. Research Finance Committee Chairman, William B. Johnson, c/o Industrial Filter & Pump Manufacturing Company, 5914 Ogden Avenue, Chicago 50, Ill.

CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary, Charles Wise, c/o The Buckeye Products Company, 7020 Vine Street, Cincinnati 16, Ohio.

CLEVELAND meets first Friday of each month in Hotel Carter at 8 P. M. Secretary-Treasurer, Harry Pochapsky, 24961 Euclid Avenue, Euclid 17, Ohio. Research Finance Committee Chairman, John D. Little, c/o The Harshaw Chemical Company, 1945 E. 97th Street, Cleveland 6, Ohio.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, John Soderberg, 40 W. Long Street, Columbus, Ohio. Research Finance Committee Chairman, Fred Brune, R. D. 7, Marion, Ohio.

DALLAS-FORT WORTH. Secretary, C. A. White, 715 W. Davis Street, Dallas 11, Texas.

DAYTON meets first Friday of each month in Engineers Club. Secretary, Paul E. Gicke, 41 S. Bromfield Road, Dayton 9, Ohio. Research Finance Committee Chairman, Robert L. Ruleff, 1002 Broadview Boulevard, Dayton 9, Ohio.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, Joseph Gurski, 8885 Littlefield, Detroit 28, Mich. Research Finance Committee Chairman, W. B. Knight, c/o Knight Plating Company, 3143 Bellevue Avenue, Detroit 11, Mich.

GRAND RAPIDS meets second Friday of each month at 7:30 P. M. in Rowe Hotel. Secretary, Keith E. Yhouse, 915 Nayhew-Wood Drive, S. E., Grand Rapids, Mich. Research Finance Committee Chairman, John W. Pulte, 308 Gladstone Avenue, S. E., Grand Rapids, Mich.

HAMILTON BRANCH meets third Thursday of each month in the Conference Room, West End Plant, Canadian Westinghouse Company, Ltd. Secretary, W. Finlay, 7 Hill Street, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

HOUSTON meets fourth Friday of each month at 7:30 P. M. Secretary-Treasurer, J. R. Byerley, Dixie Electroplating Company, 3001 Engelke Street, Houston, Texas.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 E. Washington Street. Secretary, Edward Bruck, 824 Graham Avenue, Indianapolis 1, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Hayes Hotel in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, Fred Stuckenberg, P. O. Box 501, Lansing 2, Mich.

LANCASTER meets second Friday of each month at 8 P. M. in Thaddeus Stevens Industrial School. Secretary-Treasurer, Harry A. Saylor, 40 N. Poplar Street, Elizabethtown Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway, West Lancaster, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Rodger Young Auditorium. Secretary, Stuart Krentel, 495 Terrace Street, Altadena, Calif. Research Finance Committee Chairman, Jack Beall, 1272 Inverness Drive, Pasadena, Calif.

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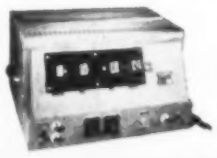

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LOUISVILLE meets third Thursday of each month in Room 119, Speed Scientific Building, University of Louisville. Secretary-Treasurer, J. W. Schell, Route 2, Georgetown, Ind. Research Finance Committee Chairman, T. K. Allison, 301 W. Main Street, Louisville 2, Ky.

MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Honorary Secretary-Treasurer, Rowland H. Keller, c/o Defence Research Laboratories, Maribyrnong, Victoria, Australia.

MILWAUKEE meets first Friday of each month in Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, E. E. Pielhsch, 2921 S. 90th Street, West Allis 14, Wis. Research Finance Committee Chairman, Phil J. Ritzenthaler, 1928 S. 62nd Street, Milwaukee 14, Wis.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary, L. A. Robillard, 3993 Lesage Street, Verdun 19, P. Q., Canada. Research Finance Committee Chairman, P. M. Condy, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

NEWARK meets third Friday of each month at 8 P. M. in Hotel Robert Treat. Secretary-Treasurer, George Wagner, 1130 S. Long Avenue, Hillside, N. J. Research Finance Committee Chairman, Edwin Bowerman, 166-41 17th Avenue, Whitestone, N. Y.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, Clark A. Brown, 46 Loller Road, Hamden, Conn. Research Finance Committee Chairman, Dr. H. L. Kellner, c/o Lea Manufacturing Company, 16 Cherry Avenue, Waterbury 86, Conn.

NEW YORK meets second and fourth Fridays of each month in Statler Hotel. Secretary-Treasurer, George Schore, 150 Bennett Avenue, New York 33, N. Y. Research Finance Committee Chairman, George F. Hermann, 52 Chestnut Street, Brooklyn 8, N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, Robert H. Tiers, c/o Pennsylvania Salt Manufacturing Company, Box 4388, Philadelphia 18, Pa.

PITTSBURGH meets second Thursday of each month in the Avon Room of Sheraton Hotel. Secretary, R. H. Schindler, 125 Fairfax Road, Forest Hills, Pittsburgh 21, Pa. Research Finance Committee Chairman, S. S. Johnston, c/o Weirton Steel Company, Weirton, W. Va.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence Engineering Society Hall, 195 Angell Street, Providence, R. I. Temporary Secretary, Dr. E. A. Parker, c/o Technic, Inc., 39 Snow Street, Providence 3, R. I. Research Finance Committee Chairman, Pierre B. Lonsbury, 78 North Avenue, Attleboro, Mass.

ROCHESTER meets third Monday of each month at Rochester Institute of Technology. Secretary, Charles B. Fideor, 180 St. Casimir Street, Rochester, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester, N. Y.

ROCKFORD meets second Monday of each month in Faust Hotel. Secretary, Kenneth Kieselburg, 419 Theodore Street, Rockford, Ill. Research Finance Committee Chairman, David Stockton, The Udylite Corporation, 1943 Walnut Street, Chicago 12, Ill.

SAGINAW VALLEY meets for dinner at 7 P. M. and meeting at 8 P. M. at Zenders, Frankenmuth, Mich., second Wednesday of each month, September through May except February. Secretary-Treasurer, Harlan L. Duley, 5074 School Street, Swartz Creek, Mich. Research Finance Committee Chairman, Alfred Knight, 113 S. Farragut Street, Bay City, Mich.

ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Hotel Elkhart, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 1720 Mishawaka Avenue, South Bend 15, Ind. Research Finance Committee Chairman, William McDowell, 211 Sycamore Street, Elkhart, Ind.

ST. LOUIS meets second Wednesday of each month in York Hotel. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research Finance Committee Chairman, H. Siegel, c/o Siegel-Roberts Plating Company, 4193 Manchester Avenue, St. Louis, Mo.

SAN FRANCISCO meets third Thursday of each month, alternating between St. Julien Restaurant, 140 Battery St., San Francisco, and El Curtola Restaurant, 510 17th St., Oakland. Secretary-Treasurer, Horace J. Smith, 319 Alta Loma Drive, South, San Francisco, Calif. Research Finance Committee Chairman, Alan Baker, 10 Bluxome St., San Francisco, Calif.

SOUTHEASTERN meets second Friday of each month in Robert Fulton Hotel, Atlanta, Ga. Secretary-Treasurer and Research Finance Committee Chairman, Dr. Fred W. Cox, Engineering Experiment Station, Georgia School of Technology, Atlanta, Ga.

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SYRACUSE meets third Monday of each month in Loyal Order of Moose Hall, 643 W. Onondaga Street. Secretary, Lindley Wood, 1329 Bellevue Avenue, Syracuse 4, N. Y. Research Finance Committee Chairman, George W. Cavanaugh, 129 Kenwood Avenue, Syracuse, N. Y.

TOLEDO meets first Thursday of each month at Commodore Perry Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, Walter E. Mark, 761 O'Connor Drive, Toronto, Canada. Research Finance Committee Chairman, C. D. Short, 1281 Pape Avenue, Toronto, Canada.

TWIN CITY meets first Monday of each month, October through June, in the Covered Wagon (Lodge Room), 114 S. 4th Street, Minneapolis, Minn., with dinner at 7:00 P. M. and business and technical session at 8:00 P. M. Secretary-Treasurer, Robert L. Buckley, c/o Industrial Chemical & Equipment Co., 205 11th Avenue So., Minneapolis 15, Minn. Research Finance Committee Chairman, E. H. Lindemann, c/o Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

WATERBURY meets second Friday of each month in Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Dr. B. Cheshire, Conn. Research Finance Committee Chairman, F. T. Eddy, Box 339, Cheshire, Conn.

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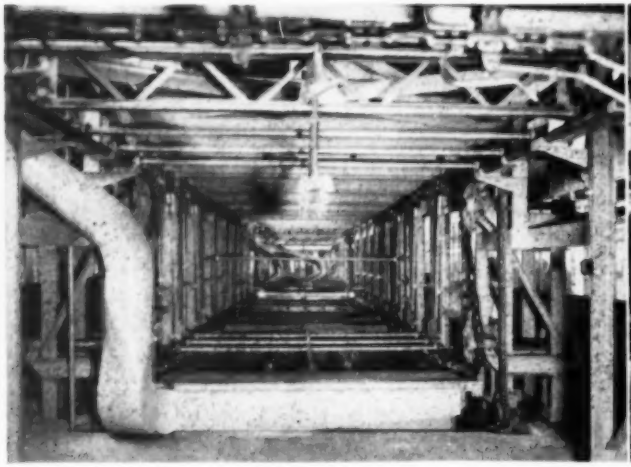

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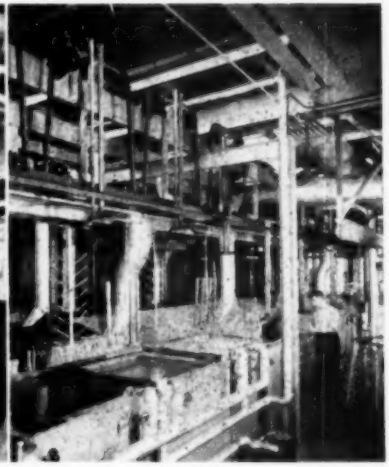

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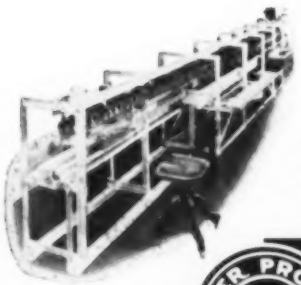

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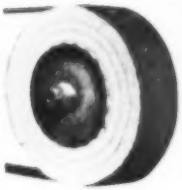

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CHICAGO BRANCH, A. E. S., Annual Educational Session and Banquet on January 26 in the Conrad Hilton Hotel (formerly the Stevens.).

NEW YORK BRANCH, A. E. S., Annual Educational Session (2:00 P. M.) and Banquet (7:00 P. M.) on February 16 in Statler Hotel.

A. S. T. M. SPRING MEETING AND COMMITTEE WEEK in Hotel Statler, Cleveland, Ohio, on March 3-7.

CHICAGO INTERNATIONAL TRADE FAIR on the Navy Pier, March 22-April 6.

THE ELECTROCHEMICAL SOCIETY'S 50TH ANNIVERSARY MEETING in Benjamin Franklin Hotel, Philadelphia, Pa., on May 4-8.

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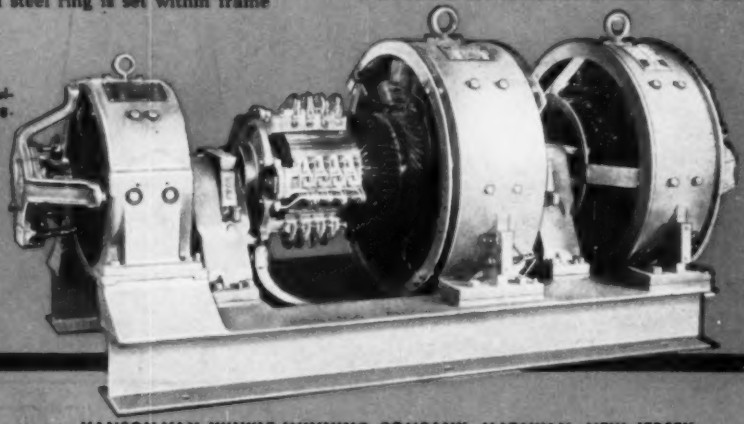

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